



# **PRODUCT DEFINITION AND USERS' GUIDE (PUG)**

## **VOLUME 5A: LEVEL 2+ PRODUCTS**

**20 March 2014**

**REVISION C.1 Interim**



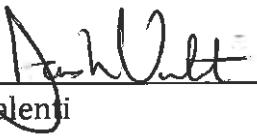
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# PRODUCT DEFINITION AND USERS' GUIDE

(PUG)

## VOLUME 5A: LEVEL 2+ PRODUCTS

  
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4/3/2014  
Date

## Responsible Organization GOES-R

HARRIS DCN -7035538  
Revision-C.1- (Interim)March 2014

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Original	N/A	09/27/2012	All	GSP – GSP is providing this document to the public for information purposes. CDRL SE-16 PUG Rev-B was formally accepted by the GSP in a contract letter dated September 7, 2012. In addition, government review comments will be addressed in the next delivery.
Post-CDR Interim Release – B1	N/A	01/30/2013	All	Post-CDR Interim Release Rev-B.1
Revision C	N/A	12/06/2013	All	<p>Post-CDR Interim Release PTR-9218 Delivery_SE-16_Product Definition and Users' Guide (PUG) Release Update Rev C</p> <p>1) Other than the instrument overview and the ABI Fixed Grid paragraph, paragraphs 1 through the end of paragraph 7.1.3 have been completely revised with new and updated content. A Standard Coordinate data paragraph has been added to the ABI Fixed Grid paragraph.</p> <p>2) Paragraphs 7.2 through the end of paragraph 8.4 have not been revised for this version of the PUG.</p> <p>3) New appendices for the CCSDS APIDS, and product refresh rates and latencies have been included.</p> <p>4) The subsequent version is identified where new content will be inserted into paragraphs that currently have headings and no content.</p> <p>PTR-7556 SE-16 PUG - Deferred GSP Comments from Rev. B.2 Review</p> <p>A subset of the deferred comments addressed related to the Radiiances product, filename conventions, GRB content and format, and several miscellaneous topics.</p> <p>PTR-9027</p> <p>SE-16 PUG - Evaluate Customer Comments Against Rev B.2</p> <p>A subset of the deferred comments addressed related to the Radiiances product, filename conventions, GRB content and format, and several miscellaneous topics.</p>
C.1	N/A	March 11, 2014	Excerpt of CMI Product	Working version.

**Responsible Organization GOES-R**

**HARRIS DCN -7035538**  
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*An excerpt from:*

# PRODUCT DEFINITION AND USERS' GUIDE (PUG)

## VOLUME 5A: LEVEL 2+ PRODUCTS

**REVISION C.1 (*Interim*)**  
**Cloud & Moisture Imagery**

**20 March 2014**

### ***Version Notes***

Harris Corporation under Contract DG133E-09-CN-0094 with NOAA develops the PUG for the GOES-R Core Ground Segment Project, delivered to the Government as CDRL SE-16, Document Control Number 7035538. The most recent delivery was Revision C, delivered December 6, 2013.

This version is an excerpt of Volume 5A of the current working document, marked as Revision C.1 (*interim*). It retains the following sections from the full version:

- 1.0 Scope
- 2.0 ABI Modes and Level 2+ Product Coverage Regions
- 4.0 Common Level 2+ Product and Data Characteristics
  - 4.1 Standards and Conventions
  - 4.2 ABI Fixed Grid
  - 4.3 Global Latitude/Longitude Grid
- 5.0 Level 2+ Product and Data Descriptions
  - 5.1 Cloud and Moisture Imagery Product

The excerpted document does not include information for other Level 2+ products, as those sections have not been finalized yet. They will be posted in an upcoming revision to the PUG on the GOES-R website.

### **NON-EXPORT CONTROLLED**

THESE ITEM(S) / DATA HAVE BEEN REVIEWED IN ACCORDANCE WITH THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR), 22 CFR PART 120.11, AND THE EXPORT ADMINISTRATION REGULATIONS (EAR), 15 CFR 734(3)(b)(3), AND MAY BE RELEASED WITHOUT EXPORT RESTRICTIONS.

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11 March 2014**RECORD OF CHANGE**

REVISION	DATE	DESCRIPTION
C.1 (interim)	11 March 2014	Excerpt of Cloud & Moisture Imagery product.

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## 1.0 SCOPE

The Product Definition and Users' Guide (PUG) document provides a product description and format users' guide for all data and products produced and made available to users by the Geostationary Operational Environmental Satellite R Series (GOES-R) Core Ground Segment (GS), developed under contract DG133E-09-CN-0094. This includes the Level 0 products, Level 1b products, GOES-R Rebroadcast (GRB), and Level 2+ products. This also includes ISO series metadata, instrument calibration data, and processing parameters and algorithm packages.

The PUG is divided into five volumes. This volume, Volume 5A: Level 2+ Products, contains Level 2+ product and data description, and content and format information. Note that there is a separate standalone Appendix X containing detailed descriptions of the ISO series metadata associated with Level 2+ products.

## 2.0 ABI MODES AND LEVEL 2+ PRODUCT COVERAGE REGIONS

There are two standard modes of operation for the ABI, Mode 3 and Mode 4. Mode 4 consists of the observation of the full disk scene every five minutes. Mode 3, also referred to as flex mode, consists of one observation of the full disk scene of the earth, three observations of the continental United States (CONUS) scene, and fifteen observations for each of two distinct mesoscale scenes during nominal operations. The CONUS scene coverage area is approximately 5000 km in the east-west direction by 3000 km in the north-south direction. The coverage area of a mesoscale scene is approximately 1000 km by 1000 km. The Mode 3 timeline, which contains the one full disk, three CONUS every five minutes, and thirty mesoscale scene observations every 30 seconds occurs every fifteen minutes. In both of these modes, there are interleaved space, blackbody, and star looks to support radiometric and navigation accuracy requirements.

Table 2.0 summarizes the standard coverage regions associated with ABI Level 2+ products.

**Table 2.0 ABI Level 2+ Products Standard Coverage Regions**

Coverage Region	Description
Full Disk	Near hemispheric earth region centered at the longitude of the sensing satellite.
CONUS	An approximately 3000 km x 5000 km region intended to cover the continental United States within the constraints of viewing angle from the sensing satellite.
Mesoscale	An approximately 1000 km x 1000 km dynamically centered region in the instrument's field of regard. The particular coverage region associated with a mesoscale product is operator- selected to support high-rate temporal analysis of environmental conditions in regions of interest.

For many Level 2+ products, product files for CONUS coverage regions are provided in Mode 4 by extracting the CONUS region from the full disk image. In addition, the required refresh rates for many Level 2+ products do not require the use of all available observations. Furthermore, there are cases when the generation of a Level 2+ product require the use of a set of observations over time, such as the case with the Derived Motion Winds product. Refer to Appendix C for detailed Level 2+ product refresh rate and latency information.

### **3.0 LEVEL 2+ ALGORITHM PRECEDENCE NETWORK**

### **4.0 COMMON LEVEL 2+ PRODUCT AND DATA CHARACTERISTICS**

The Level 2+ products and data other than the related ISO series metadata and processing parameters are output using the Network Common Data Format version 4 (netCDF-4) file format.

The Level 2+ products contain processed observation data of the earth's surface and atmosphere. Many of the ABI Level 2+ products are provided for one or more of the full disk, continental United States, and mesoscale regions.

The ABI Level 2+ gridded product data is either on the native ABI fixed grid or global latitude/longitude grid. The Level 2+ non-gridded products, which include the Lightning Detection, Derived Motion Winds, and Hurricane Intensity, are composed of data located to specific latitude and longitude coordinates.

The Level 2+ products conform to the prevailing standards and conventions applicable to netCDF-4 product files. The Level 2+ product data have coordinates, many of which are common to multiple Level 2+ products. The Level 2+ products have an indicator of quality for each primary product data value. Additionally, the Level 2+ products have common product statistics.

The typical ABI Level 2+ gridded product file contains a single image whose pixels are associated with an environmental physical quantity, such as cloud top height, per-pixel data quality flags, and product-level summary statistics that provide indications of the quality of the image.

Subordinate paragraphs follow that address:

- Applicable standards and conventions.
- ABI fixed grid.
- Global latitude/longitude grid.
- Common Level 2+ product coordinates.
- Common Level 2+ product data quality variables.
- Common Level 2+ product statistics.

The detailed descriptions of the ISO series metadata for GOES-R Level 2+ products are located in , GOES-R ISO Series Metadata. This is a special standalone appendix to the PUG. This appendix includes a table of contents with a paragraph reference to each ISO series metadata file.

#### **4.1 Standards and Conventions**

The Level 2+ products and data conform to the netCDF Users' Guide (NUG) recommended attributes where applicable. The NUG recommended attributes are identified and described in the main PUG volume.

The Level 2+ products and data conform to Unidata's Attribute Conventions for Data Discovery (ACDD) recommended where applicable. Unidata's ACDD are identified and described in the main PUG volume. Conforming to this set of conventions enables cataloguing product files with information contained in the product files.

The ABI Level 2+ products conform to the Climate and Forecast (CF) Metadata Conventions. The CF Metadata Conventions, and how these conventions are applied to these products are described in the main PUG volume. Conforming to the CF metadata conventions enable the Level 2+ product files to be self-describing.

#### **4.2 ABI Fixed Grid**

The ABI fixed grid is the projection associated with the data in the ABI Level 1b Radiances products, and all the ABI Level 2+ products except for the Derived Motion Winds, Hurricane Intensity, and Shortwave Radiation products.

This paragraph includes the following subordinate paragraphs:

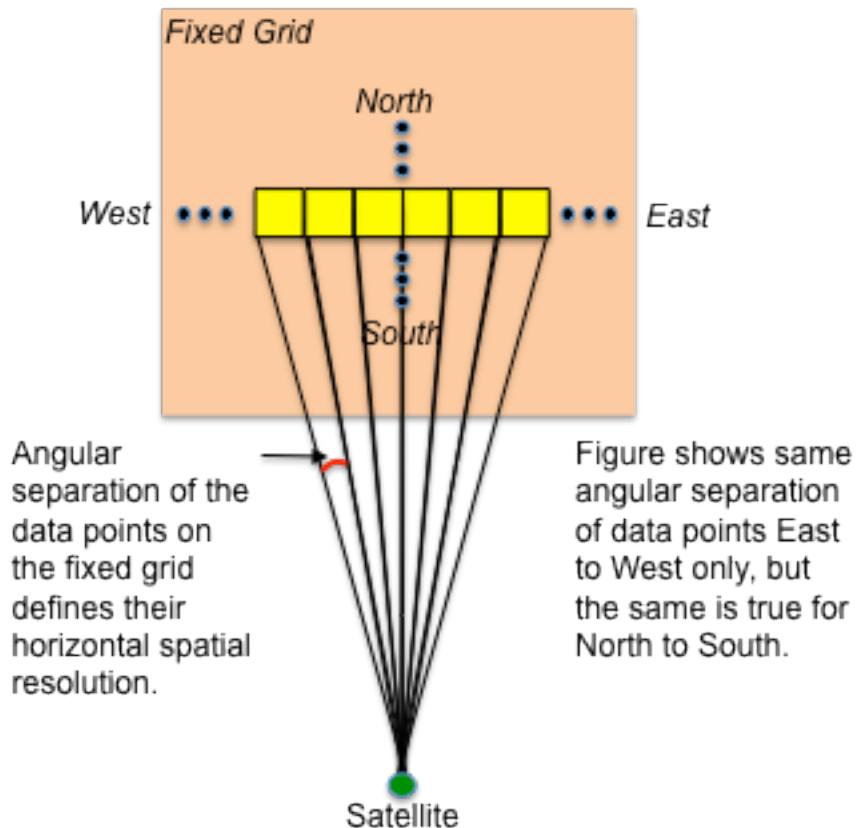
- Description
- Coordinate System
- Coverage Area Associated with the Full Disk, CONUS, and Mesoscale Images
- Horizontal Spatial Resolutions
- Data Point Coordinates
- Product Data Structures
- Standard Coordinate Data
- Navigation of Image Data
- Overlaying Data from Different Image Types

#### **4.2.1      Description**

The data points in the GOES-R ABI Level 1b and the ABI Level 2+ imagery products are on the ABI fixed grid. The ABI fixed grid is a projection based on the viewing perspective of the idealized location of a satellite in geosynchronous orbit. This allows the same data points in every product to be at the same location on the earth. All of the dynamics associated with an orbiting satellite are removed from the data to accomplish this. GOES-R ground system product processing functionality receives raw data from the ABI instrument and performs the processing required to place the data points on the ABI fixed grid.

The fixed grid is rectified to a GRS80 ellipsoid viewed from the idealized geostationary position. This defines the ellipsoid parameters to use when geo-referencing data points on the fixed grid. Data points are defined out to the edge of the earth's limb as defined by the GRS80 ellipsoid.

Data points at a particular horizontal spatial resolution on the fixed grid have the same angular separation from the satellite's viewing perspective in both east to west and north to south directions. Refer to Figure 4.2.1.

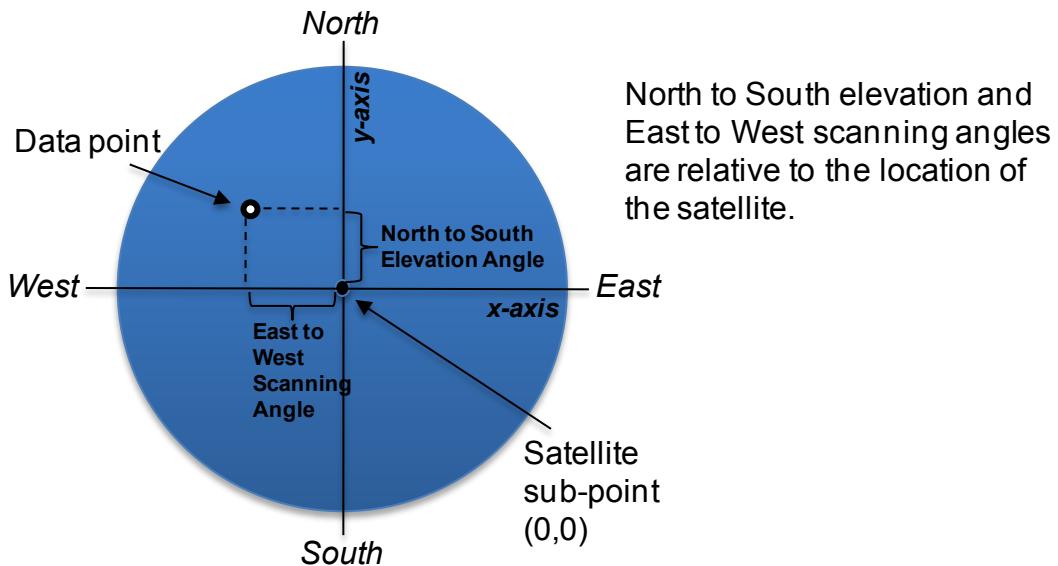


**Figure 4.2.1 Data Points Have The Same Angular Separation On The Fixed Grid**

The angular separation of the data points on the fixed grid provides the basis for the spatial resolution of the imagery data points, and is used to determine their coordinates. From the viewpoint of a right-hand coordinate system of the idealized geostationary satellite with the x-axis in the direction of the satellite velocity and the z-axis pointed at nadir, the north to south angle (i.e. N/S elevation angle) is determined by a rotation about the x-axis. The east to west angle (i.e. E/W scanning angle) is determined by a rotation about the rotated y-axis. Note that the earth surface area covered by a data point at a specific horizontal spatial resolution increases as the distance from the satellite's nadir increases.

#### 4.2.2 Coordinate System

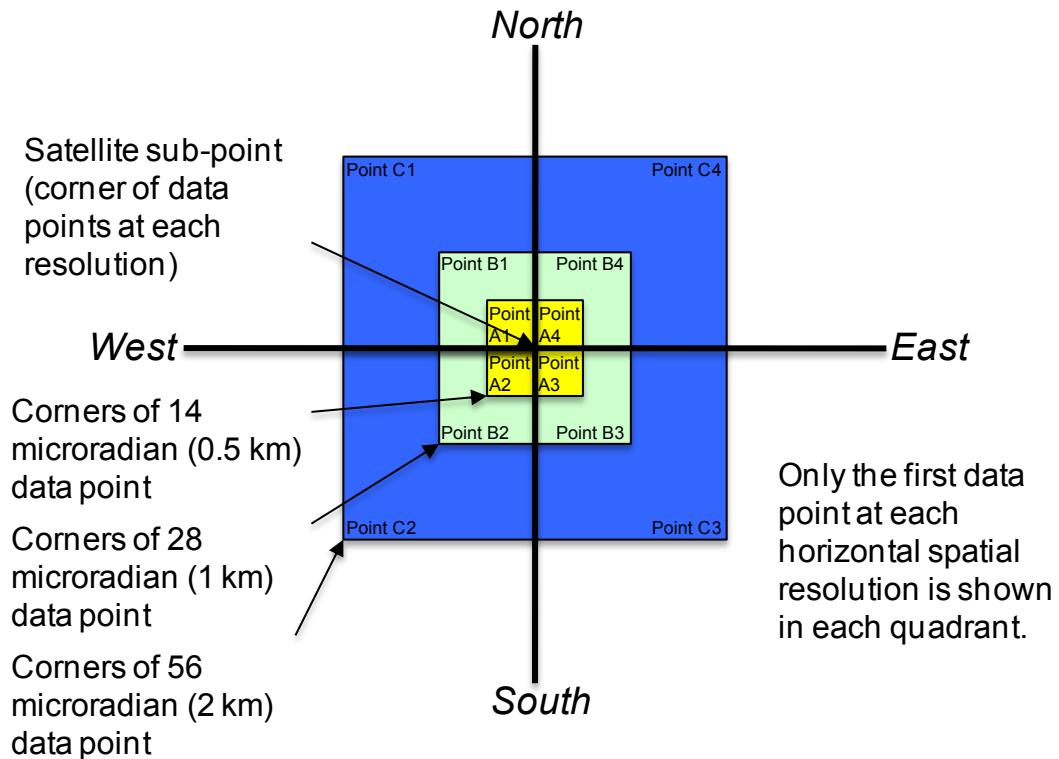
The ABI fixed grid is expressed in terms of the Cartesian coordinate system. The x axis represents the ABI E/W scan angle, i.e., the east-to-west direction. The y axis represents the ABI N/S scan angle, i.e., the north-to-south direction. The origin of the fixed grid represents the satellite sub-point which, by definition, is at the coordinate, (y = 0, x = 0). Refer to Figure 4.2.2-1, ABI Fixed Grid Coordinate System.



**Figure 4.2.2-1 ABI Fixed Grid Coordinate System**

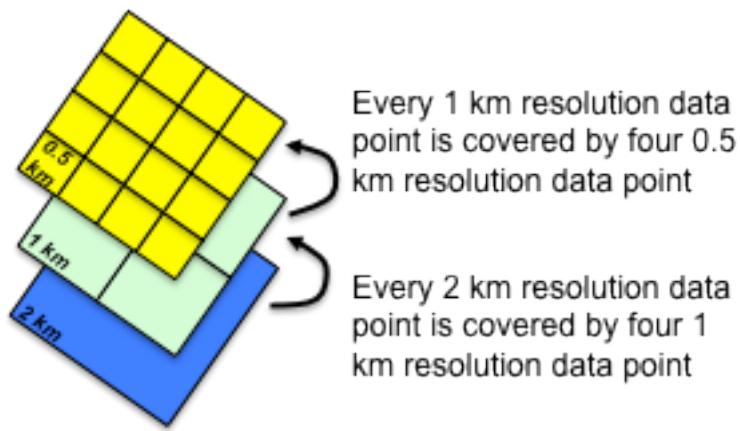
The ABI native spatial resolutions are 0.5, 1.0, and 2.0 km at nadir. The radian is the standard unit of measure of the fixed grid. It is used to express the angular separation between imagery data points, which are 14, 28, and 56 microradians, respectively. For the ABI L2+ products that have less spatial resolution (i.e. coarser distance between data points), the analogous spatial resolutions and angular separations apply. For example, ABI L2+ products with a spatial resolution of 10 km at nadir have data points with an angular separation of 280 microradians.

The ABI fixed grid coordinate system dictates that the ideal satellite sub-point is at the corner of four imagery data points for the ABI native resolutions. Refer to Figure 4.2.2-2.



**Figure 4.2.2-2      Fixed Grid Data Point Locations Relative to the Satellite Sub-Point**

A 2 km data point subsumes four 1 km data points exactly. A 1 km data point subsumes four 0.5 km data points exactly. Refer to Figure 4.2.2-3. Note that for each of the full disk, CONUS, and mesoscale products, this relationship holds true when the lower resolution data is a multiple of the higher resolution data.



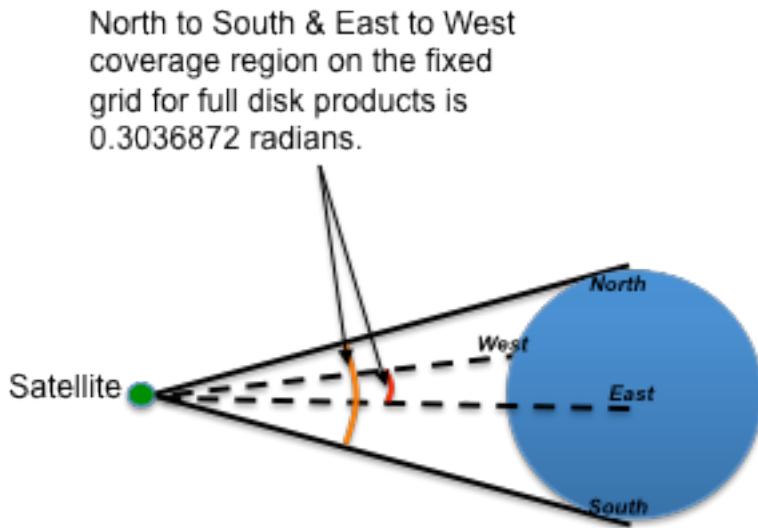
**Figure 4.2.2-3      Relationship Between Data Points at Different Resolutions**

ABI fixed grid imagery data points can be located on the earth. Knowing the (1) satellite sub-point longitude, (2) horizontal spatial resolution of the imagery data, (3) distance of the ideal geostationary

satellite location from the earth, and (4) the selected earth model (GRS80) allows the location on the earth of each data point on the fixed grid to be determined.

#### 4.2.3 Coverage Regions Associated with the Full Disk, CONUS, and Mesoscale Images

The coverage associated with the ABI images is defined in terms of the viewing angle of the earth from the satellite perspective. Note that the term “scene” is used to communicate what the ABI instrument observes. The term, “image,” is used to communicate the product data resulting from the scene. Refer to Figure 4.2.3.



**Figure 4.2.3** ABI Coverage Regions are Defined In Terms of Viewing Angle From The Satellite’s Perspective

Table 4.2.3-1 defines the coverage region for a full disk image. Note that the center of the full disk image is the satellite sub-point.

**Table 4.2.3-1 Full Disk Image Coverage Region**

East to West Coverage Extent	0.3036872 radians
North to South Coverage Extent	0.3036872 radians

Table 4.2.3-2 defines the coverage region for a CONUS image. The CONUS coverage region extents are relative to the center of the CONUS image.

**Table 4.2.3-2 CONUS Image Coverage Region**

East to West Coverage Extent	0.14 radians
North to South Coverage Extent	0.084 radians

Table 4.2.3-3 and Table 4.2.3-4 define the precise location of the center of the CONUS regions sensed by the ABI for the GOES-R East and West satellites at 75 degrees and 137 degrees west longitude. Note that a negative fixed grid coordinate indicates a data point that is either west or south of the satellite sub-point. Also note that the CONUS image center points are subject to change.

**Table 4.2.3-3 GOES-R East CONUS Image Center**

East to West Image Offset from Satellite Sub-point	-0.040248647 radians
North to South Image Offset from Satellite Sub-point	0.084625052 radians

**Table 4.2.3-4 GOES-R West CONUS Image Center**

East to West Image Offset from Satellite Sub-point	0.082900064 radians
North to South Image Offset from Satellite Sub-point	0.083759424 radians

Table 4.2.3-5 defines the coverage region for a mesoscale image. The mesoscale coverage region extents are relative to the center of the mesoscale image. The center of a mesoscale image is selected during operations based on weather conditions in the ABI's field of regard.

**Table 4.2.3-5 Mesoscale Image Coverage Region**

East to West Coverage Extent	0.028 radians
North to South Coverage Extent	0.028 radians

Note that the center of each CONUS image and mesoscale image is adjusted to the image corner that is nearest to the fixed grid data point.

#### 4.2.4 Horizontal Spatial Resolutions

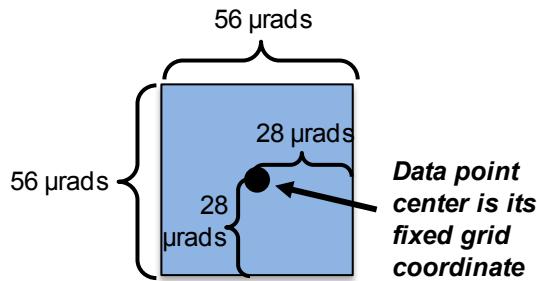
The GOES-R ground system outputs ABI Level 1b and ABI Level 2+ imagery products on the ABI fixed grid at several horizontal spatial resolutions. Table 4.2.4 identifies the set of horizontal spatial resolutions associated with the different types of products. Note that the horizontal spatial resolutions are specified in terms of resolution in kilometers at nadir, and angular resolution as defined above.

**Table 4.2.4 Horizontal Spatial Resolution**

ABI L1b/GRB	ABI L2+	Horizontal Spatial Resolution	
		At Nadir	Angular
applicable	applicable	0.5 km	14 $\mu$ rad
		1.0 km	28 $\mu$ rad
		2.0 km	56 $\mu$ rad
		4.0 km	112 $\mu$ rad
		10.0 km	280 $\mu$ rad
not applicable			

#### 4.2.5 Data Point Coordinates

An imagery data point on the ABI fixed grid is associated with an area on or above the surface of the earth. For example, a data point with a horizontal spatial resolution of 2 km at nadir is associated with a 4 square kilometer area. By convention, a data point is located at the center of this area with its coordinates expressed in terms of its angular resolution. For example, the center of a 2 km data point, which has an angular resolution of 56 microradians in both N/S elevation angle and E/W scanning angle, is 28 microradians from its edges. Refer to Figure 4.2.5.



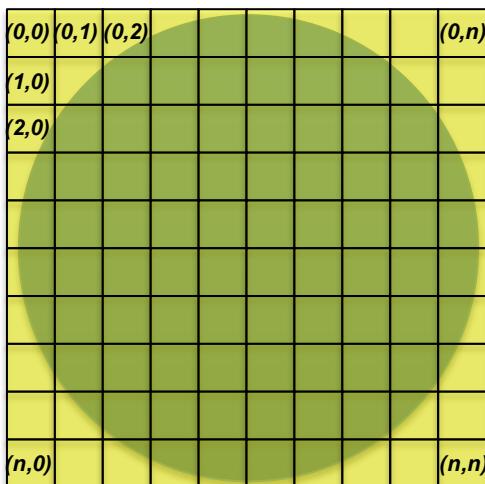
**Figure 4.2.5 Example: Center of 2 km Data Point**

#### 4.2.6 Product Data Structures

In the preceding paragraphs that discussed the ABI fixed grid, the specification of its coordinate system, and the size and locations of its data points have been defined. This paragraph defines how this information is captured in the ABI Level 1b and ABI Level 2+ imagery products.

The ABI Level 1b and ABI Level 2+ products are stored in netCDF version 4 product files. netCDF includes constructs to define scalar and multi-dimensional data, along with the associated metadata. netCDF variables are used to store scalar and multi-dimensional data. Metadata can be stored using either netCDF variables or attributes. The Climate and Forecast (CF) Metadata Conventions are applied to make the ABI Level 1b and ABI Level 2+ products self-describing. This standard includes requirements that allow the data to be located in space and time, as well as the semantics of the data to be captured in the product file.

For full disk products, the netCDF variables used to house the values for data points on the fixed grid define a rectangular region that encompasses the elliptical earth. Note that fill values are used for off-earth and missing data points. Refer to Figure 4.2.6-1.



- NetCDF variables provide storage for data point values on the fixed grid.
- Array element (0,0) of variable contains the data value for the most northwest data point.
- Array element (n, n) of variable contains the data value for the most southeast data point.

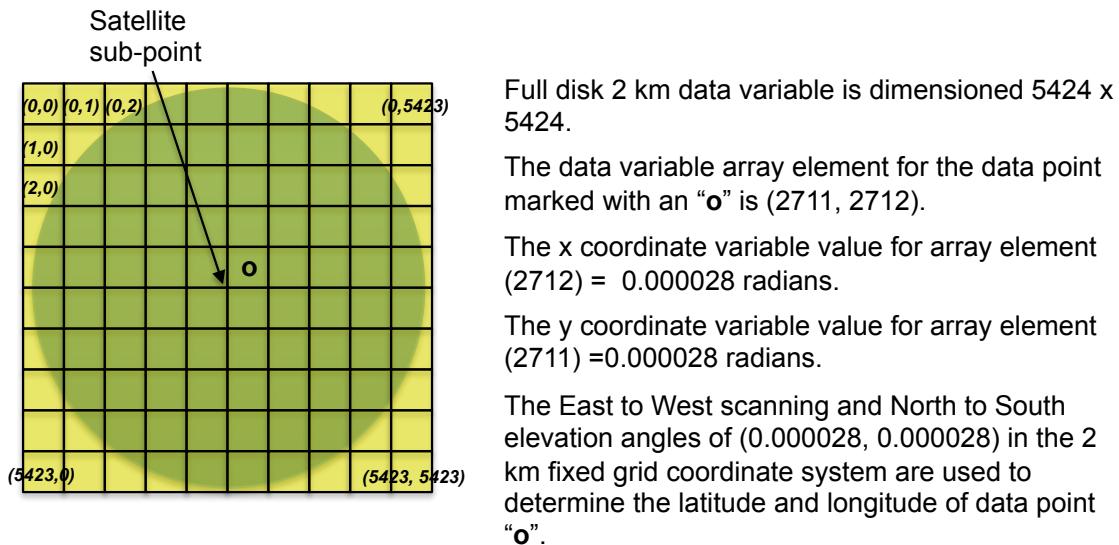
**Figure 4.2.6-1 Storing Data Point Values For Full Disk Image in a Variable**

CONUS and mesoscale images are stored in a similar manner.

When netCDF values for data points are reported for single levels in the atmosphere, the variable has two dimensions, with ordered pair value (0, 0) being the most northwest data point and ordered pair value (n,n) being the most southeast data point. Note that the first element of an ordered pair represents the fixed grid y-axis, while the second element represents the fixed grid x-axis, i.e., (n<sub>y</sub>,n<sub>x</sub>).

When netCDF data values are reported for multiple levels in the atmosphere, the data variable has three dimensions. The data variable subscripting is in the form (y, x, z) where z provides the dimension to store multiple values at the same location on the fixed grid.

In addition to the netCDF variables containing the data, there are coordinate variables in the product file. Coordinate variables, which are a CF metadata convention construct, provide the means to locate the data in space and time. Coordinate variables are required for the time, and the location along the y and x axes. The CF metadata conventions dictate that the coordinate variable names be the same as the corresponding dimension names. The values of data elements in the y and x coordinate variables are the ABI fixed grid coordinates, the N/S elevation angle and the E/W scanning elevation angle, respectively. Note that scaled integers as defined in the netCDF Users Guide are used for the y and x axis coordinate variables. The coordinate variable value in the product file is multiplied by the attached attribute scale\_factor and then the add\_offset to obtain the ABI fixed grid coordinate in radians. The y and x coordinate variables are one-dimensional. The dimension of the y coordinate variable is the same as the y dimension in the data variable. The same is true for the x coordinate variable. This allows specific data points in the data variable to be associated with their ABI fixed grid coordinates. Refer to Figure 4.2.6-2.



**Figure 4.2.6-2 Relating a Data Point to its ABI Fixed Grid Coordinates**

In the GRB form of the ABI Level 1b Radiances product, the y- and x-coordinate variables, which are included in the Generic Payload containing the product metadata, are not populated. In this case, the y- and x-coordinate variables can be determined using the upper left y- and x-coordinates of the data points in the image, along with the image block height field and the image block width field contained in the Image Payload Header.

Determining the latitude and longitude of data points using their ABI fixed grid coordinates is defined in paragraph 4.2.8, Navigation of Image Data, that follows.

The dimensions of the data variables for ABI Level 1b and 2+ full disk, CONUS, and mesoscale products are defined in Table 4.2.6.

**Table 4.2.6 ABI Product Data Variable Dimensions**

Horizontal Spatial Resolution		Full Disk		CONUS Extraction from Full Disk		CONUS		Mesoscale	
km (nadir)	micro-radian s	N/S (y-axis)	E/W (x-axis)	N/S (y-axis)	E/W (x-axis)	N/S (y-axis)	E/W (x-axis)	N/S (y-axis)	E/W (x-axis)
0.5	14	21696	21696	6000	10000	6000	10000	2000	2000
1.0	28	10848	10848	3000	5000	3000	5000	1000	1000
2.0	56	5424	5424	1500	2500	1500	2500	500	500
4.0	112	2712	2712	not applicable				250	250
10.0	280	1086	1086	301	501	300	500	100	100

There are two conventions associated with the dimensioning of variables for image data on the fixed grid. In the first convention, the dimensioning of the lowest native resolution data points (2 km at nadir) completely covers the full disk, CONUS, and mesoscale images defined above. In the second convention, the higher native resolution data points (i.e., 0.5, 1, and 2 km at nadir) and the lower non-native resolution data points (i.e., 4, 5, and 10 km at nadir) fully cover the region defined by the native 2 km at nadir resolution product.

Full disk and mesoscale products have the same dimensioning value for both the x and y axes. The ABI Level 2+ 10 km CONUS product extracted from a full disk image has an additional row and column so that it fully overlaps the ABI Level 2+ 10 km CONUS product derived from a native CONUS scene. The need to include an additional row and column is due to the fact that the distance between (1) the satellite subpoint, which is the fixed grid coordinate system origin for both the GOES-R East and West satellites and (2) the default CONUS image center as specified above, is not at a multiple of data points having a horizontal spatial resolution of 10 km at nadir. The implication of this subtlety is the location of pixels having a horizontal spatial resolution of 10 km is different for native versus full disk extracted CONUS products.

As a result of the selected center location, the same issue potentially arises for mesoscale products having a horizontal spatial resolution of greater than 2 km at nadir. These lower resolution mesoscale products can have data points that do not cover the same area as data points in full disk products having the same resolution.

#### 4.2.7 Standard Coordinate Data

There are several netCDF variables and attributes in the ABI Level 1b and ABI Level 2+ products on the fixed grid that contain coordinate related information required to geo-locate data points in the product. The standard coverage areas associated with full disk and CONUS products result in coordinate data values that do not change for a satellite positioned at one of the two operational slot, -75 degrees east and -137 degrees east. These standard and fixed coordinate data are identified and described in this paragraph.

Table 4.2.7-1 defines the variables and attributes that contain standard coordinate data.

**Table 4.2.7-1 Variables and Attributes Containing Standard Coordinate Data**

Variable / Attribute	Description
y -> add_offset x -> add_offset	Attribute add_offset of coordinate variables "y" and "x" contains the N/S elevation and E/W scanning angles for center, respectively, of the upper left (i.e. most northwest) data point in the image. This value varies with the location of the image for mesoscale.
y -> scale_factor x -> scale_factor	Attribute add_offset of coordinate variables "x" and "y" contains the horizontal spatial resolution of the image.
y_image_center x_image_center	These coordinate variables contain the N/S elevation and E/W scanning angles, respectively, of the center the image. These values vary with the location of the image for mesoscale.
y_image_bounds x_image_bounds	These boundary variables contain the N/S elevation and E/W scanning angles of the north and south, and west and east, extents, respectively, of the image. These values vary with the location of the image for mesoscale.
geospatial_lat_lon_extent -> geospatial_lat_nadir geospatial_lat_lon_extent -> geospatial_lon_nadir  geospatial_lat_lon_extent -> geospatial_lat_center geospatial_lat_lon_extent -> geospatial_lon_center  geospatial_lat_lon_extent -> geospatial_northbound_longitude geospatial_lat_lon_extent -> geospatial_southbound_longitude geospatial_lat_lon_extent -> geospatial_westbound_longitude geospatial_lat_lon_extent -> geospatial_eastbound_longitude	This variable and its attributes contain the latitude and longitude of the satellite's nadir, center of the image, and north, south, west, and east extents of the image. Except for the satellite's nadir, these values vary with the location of the image for mesoscale.

Table 4.2.7-2 identifies the N/S elevation and E/W scanning angles of the center of the most northwest pixel in full disk and CONUS images (i.e., y and x coordinate variables' add\_offsets), and the y and x coordinate variables' scale\_factors.

**Table 4.2.7-2 ABI Image Standard Upper Left Coordinates**

Horizontal Spatial Resolution		Full Disk		CONUS (GOES-R East at -75 degrees east longitude)		CONUS (GOES-R West at -137 degrees north longitude)		All Image Types
km (nadir)	micro-radians	add offset for y	add offset for x	add offset for y	add offset for x	add offset for y	add offset for x	scale factor for y & x
0.5	14	0.151865	-0.151865	0.126609	-0.110257	0.125769	0.011767	0.000014
1.0	28	0.151858	-0.151858	0.126602	-0.110250	0.125762	0.011774	0.000028
2.0	56	0.151844	-0.151844	0.126588	-0.110236	0.125748	0.011788	0.000056
4.0	112	0.151816	-0.151816	not applicable				0.000112
10.0	280	0.151900	-0.151900	0.126700	-0.110180	0.125860	0.011900	0.000280

Table 4.2.7-3 ABI Image Center (Fixed Grid Coordinates) identifies the N/S elevation and E/W scanning angles of the center of full disk and CONUS images (i.e. y\_image\_center and x\_image\_center coordinate variables).

**Table 4.2.7-3 ABI Image Center (Fixed Grid Coordinates)**

Horizontal Spatial Resolution		Full Disk		CONUS (GOES-R East at -75 degrees east longitude)		CONUS (GOES-R West at -137 degrees north longitude)	
km (nadir)	micro-radians	y_image_center	x_image_center	y_image_center	x_image_center	y_image_center	x_image_center
0.5	14	0.0	0.0	0.084616	-0.040264	0.083776	0.082320
1.0	28	0.0	0.0	0.084616	-0.040264	0.083776	0.082320
2.0	56	0.0	0.0	0.084616	-0.040264	0.083776	0.082320
4.0	112	0.0	0.0	not applicable			
10.0	280	0.0	0.0	0.084616	-0.040264	0.083776	0.082320

Table 4.2.7-4 identifies the N/S elevation angles of the N/S extents of full disk and CONUS images (i.e. y\_image\_bounds boundary variable).

**Table 4.2.7-4 ABI Image N/S Extents (Fixed Grid Coordinates)**

Horizontal Spatial Resolution		Full Disk		CONUS (GOES-R East at -75 degrees east longitude)		CONUS (GOES-R West at -137 degrees north longitude)	
km (nadir)	micro-radians	y_image_bounds north	y_image_bounds south	y_image_bounds north	y_image_bounds south	y_image_bounds north	y_image_bounds south
0.5	14	0.151872	-0.151872	0.126616	0.042616	0.125776	0.041776
1.0	28	0.151872	-0.151872	0.126616	0.042616	0.125776	0.041776
2.0	56	0.151872	-0.151872	0.126616	0.042616	0.125776	0.041776
4.0	112	0.151872	-0.151872	not applicable			
10.0	280	0.152040	-0.152040	0.126616	0.042616	0.125776	0.041776

Table 4.2.7-5, ABI Image E/W Extents (Fixed Grid Coordinates) identifies the E/W scanning angles of the E/W extents of full disk and CONUS images (i.e. x\_image\_bounds boundary variable).

**Table 4.2.7-5 ABI Image E/W Extents (Fixed Grid Coordinates)**

Horizontal Spatial Resolution		Full Disk		CONUS (GOES-R East at -75 degrees east longitude)		CONUS (GOES-R West at -137 degrees north longitude)	
km (nadir)	micro-radians	y_image_bounds west	y_image_bounds east	y_image_bounds west	y_image_bounds east	y_image_bounds west	y_image_bounds east
0.5	14	-0.151872	0.151872	-0.110264	0.029736	0.011760	0.151760
1.0	28	-0.151872	0.151872	-0.110264	0.029736	0.011760	0.151760
2.0	56	-0.151872	0.151872	-0.110264	0.029736	0.011760	0.151760
4.0	112	-0.151872	0.151872	not applicable			
10.0	280	-0.152040	0.152040	-0.110264	0.029736	0.011760	0.151760

Table 4.2.7-6 identifies the latitude and longitude of the center and extents of full disk and CONUS images (i.e. geospatial\_lat\_lon\_extent variable attributes).

**Table 4.2.7-6 ABI Image Center and Extents (Lat/Lon Coordinates)**

Latitude is degrees north Longitude is degrees east	Full Disk (GOES-R East at -75 degrees longitude)	Full Disk (GOES-R West at -137 degrees longitude)	CONUS (GOES-R East at -75 degrees longitude)	CONUS (GOES-R West at -137 degrees longitude)
geospatial_lat_nadir	0.0	0.0	0.0	0.0
geospatial_lon_nadir	-75.0	-137.0	-75.0	-137.0
geospatial_lat_center	0.0	0.0	29.5004	29.8360
geospatial_lon_center	-75.0	-137.0	-90.5385	-103.1168
geospatial_northbound_longitude	81.3282	81.3282	55.6790	55.1223
geospatial_southbound_longitude	-81.3282	-81.3282	14.0097	13.7305
geospatial_westbound_longitude	-156.2995	141.7005	-153.1198	-133.0998
geospatial_eastbound_longitude	6.2995	-55.7005	-58.7853	-56.0413

## 4.2.8 Navigation of Image Data

This paragraph provides the equations needed to navigate data points on the ABI fixed grid to and from latitude and longitude. ABI fixed grid coordinates, N/S elevation angle and E/W scanning angle, coupled

with the location of the satellite and the parameters associated with the selected earth model (GRS80) are used to determine the geodetic latitude/longitude coordinates. This paragraph also provides equations to determine the ABI fixed grid coordinates from the geodetic latitude/longitude coordinates.

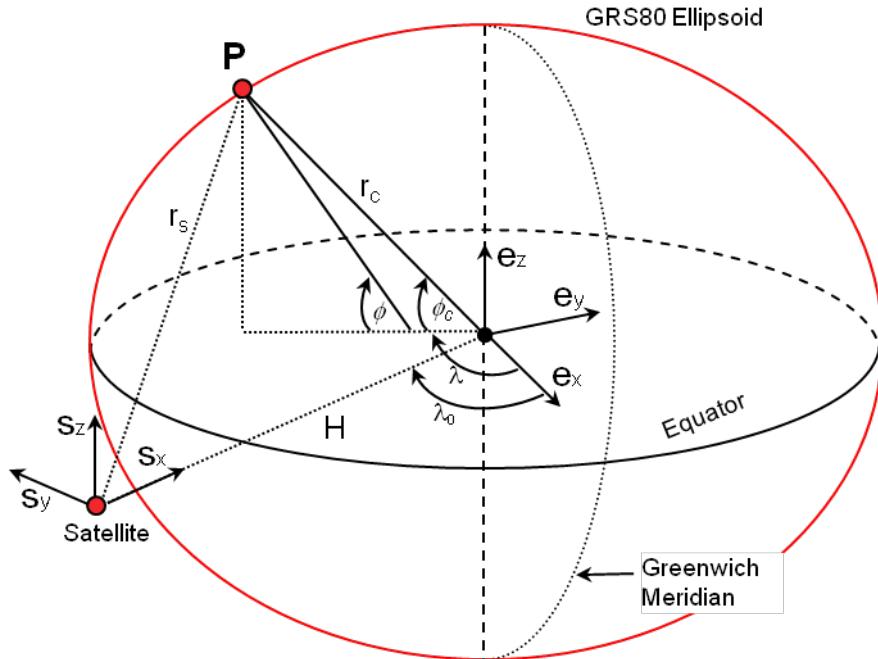
All of the equations are based on the International System of Units (SI). These equations assume data points are lying on the GRS80 ellipsoid, and the location of data points on the ABI Fixed Grid is based on a geostationary satellite at the equator in an idealized orbit.

Table 4.2.8 defines the parameters required to navigate data points on the ABI Fixed Grid. The parameters are used in the equations in the following sections.

**Table 4.2.8 Parameters Required to Navigate Data Points on ABI Fixed Grid**

Parameter	netCDF Product File Attributes for the "goes_imager_projection" Variable	Attribute Value	Definition
$r_{eq}$	semi_major_axis	6378137 m	GRS80 semi-major axis of earth
$1/f$	inverse_flattening	298.257222096	Reciprocal of GRS80 flattening factor
$r_{pol}$	semi_minor_axis	6356752.31414 m	GRS80 semi-minor axis of earth = $(1-f)r_{eq}$
$e$	n/a	0.0818191910435	$1^{\text{st}}$ eccentricity = $\sqrt{f(2-f)}$ = $\sqrt{(r_{eq}^2 - r_{pol}^2)/r_{eq}^2}$
n/a	perspective_point_height	35786023 m	Satellite height above ellipsoid
$H$	perspective_point_height + semi_major_axis	42164160 m	Satellite height from center of earth (m)
$x$	x	Input or Output Value rad	Fixed Grid E/W scanning angle (rad)
$y$	y	Input or Output Value rad	Fixed Grid N/S elevation angle (rad)
$\phi$		Input or Output Value deg/rad	GRS80 geodetic latitude (deg/rad)
$\lambda$		Input or Output Value deg/rad	GRS80 longitude (deg/rad)
n/a	latitude_of_projection_origin	0 deg 0 rad	Satellite East latitude North
		0 deg 0 rad	Satellite West latitude North
$\lambda_0$	longitude_of_projection_origin	-75 deg -1.308996939 rad	Satellite East longitude East
		-137 deg -2.39110107523 rad	Satellite West longitude East

Figure 4.2.8 provides an illustration of the coordinate frames and their relationships required for navigation. The equations in the following paragraphs are based on this figure.



**Figure 4.2.8      Coordinate Frames for ABI Fixed Grid Navigation**

Two coordinate frames are described. The Earth Centered Fixed (ECF) coordinate frame rotates with the Earth. The origin is located at the center of the earth. The x-axis ( $e_x$ ) passes through the Greenwich Meridian and the equator. The z-axis ( $e_z$ ) passes through the North Pole. The y-axis ( $e_y$ ) is defined as the cross product of the z-axis ( $e_z$ ) with the x-axis ( $e_x$ ) completing the right-handed coordinate system. The satellite coordinate frame has its origin located at the center of mass of the satellite. Its x-axis ( $s_x$ ) is defined along the line from the satellite to the center of the earth and the z-axis ( $s_z$ ) is parallel to the ECF z-axis ( $e_z$ ) and points up. Again the y-axis ( $s_y$ ) completes the right-handed coordinate system and is aligned with the equatorial axis. Two representations are shown for the latitude. The  $\phi$  represents the geodetic latitude, and  $\phi_c$  represents the geocentric latitude. Note that the geodetic latitude is measured at the equator, where the line is perpendicular or normal to the GRS80 ellipsoid at point P. The geodetic and geocentric longitudes  $\lambda$  are the same. Longitude is measured from the Greenwich meridian and is positive East and negative West. Note that the geostationary positions of the GOES-R satellites are both west of the Greenwich Meridian and therefore have negative longitudes as shown in the table immediately above.

Note that the open-source Unidata Geolocation Projection and Proj.4 Cartographic Projections software will be available on the web at:

- <http://www.unidata.ucar.edu/software/netcdf-java/v4.0/javadoc/ucar/unidata/geoloc/projection/package-summary.html>
- <http://trac.osgeo.org/proj/wiki/proj%3Dgeos>

#### 4.2.8.1      Navigating from N/S Elevation Angle (y) and E/W Scanning Angle (x) to Geodetic Latitude ( $\phi$ ) and Longitude ( $\lambda$ )

Given a point P on the GRS80 ellipsoid with fixed grid coordinates (y,x) find the geodetic coordinates, ( $\phi, \lambda$ ).

The geodetic latitude ( $\phi$ ) and longitude ( $\lambda$ ) are computed by the following equations

$$\begin{pmatrix} \phi \\ \lambda \end{pmatrix} = \begin{pmatrix} \arctan\left(\frac{r_{eq}^2}{r_{pol}^2} \frac{s_z}{\sqrt{(H - s_x)^2 + s_y^2}}\right) \\ \lambda_0 + \arctan\left(\frac{s_y}{H - s_x}\right) \end{pmatrix}$$

For:

$x$  = Fixed Grid E/W scan angle in radians

$y$  = Fixed Grid N/S scan angle in radians

One computes  $S_x$ ,  $S_y$ ,  $S_z$  as follows:

$$a = \sin^2(x) + \cos^2(x) \left( \cos^2(y) + \frac{r_{eq}^2}{r_{pol}^2} \sin^2(y) \right)$$

$$b = -2H \cos(x) \cos(y)$$

$$c = H^2 - r_{eq}^2$$

$$r_s = \frac{-b - \sqrt{b^2 - 4ac}}{2a} \text{ distance from the satellite to point P}$$

$$s_x = r_s \cos(x) \cos(y)$$

$$s_y = r_s \sin(x)$$

$$s_z = r_s \cos(x) \sin(y)$$

### Example

This example is based on the GOES-R east satellite for a point, P, in a 2 km CONUS product with fixed grid coordinates given by

$$y(558) = 0.095340 \text{ rad}$$

$$x(1539) = -0.024052 \text{ rad}$$

Note the variables and their subscripts used here are as defined in paragraph 4.2.6, Product Data Structures, above.

Values for the parameters used in the equations and their netCDF Product File Attribute Names described in the table immediately above are as follows:

$$r_{eq} = \text{goes\_imagery\_projection:semi\_major\_axis} = 6378137 \text{ (meters)}$$

$$1/f = \text{goes\_imagery\_projection:inverse\_flattening} = 298.257222096$$

$$r_{pol} = \text{goes\_imagery\_projection:semi\_minor\_axis} = 6356752.31414 \text{ (meters)}$$

$$e = 0.0818191910435$$

```

goes_imagery_projection:perspective_point_height = 35786023 (meters)
H = goes_imagery_projection:perspective_point_height +
      goes_imagery_projection:semi_major_axis = 42164160 (meters)
x = x(1539) = -0.024052
y = y(558) = 0.095340
λ₀ = goes_imagery_projection:longitude_of_projection_origin
      = -1.308996939
  
```

Based on these input values, the intermediate calculations in the above equations yield the following:

```

a = 1.000061039
b = -83921070.03
c = 1.73714E+15
rₛ = 37116295.87
sₓ = 36937048.73
sᵧ = -892635.0779
sₜ = 3532287.213
  
```

Now using the values specified above and substituting into the equations for  $\phi$  and  $\lambda$ , we obtain the following for the geodetic latitude and longitude,

$$\begin{aligned}\phi &= 0.590726971 \text{ rad} = 33.846162 \text{ deg} \\ \lambda &= -1.478135612 \text{ rad} = -84.690932 \text{ deg}\end{aligned}$$

corresponding to the GOES-R east satellite fixed grid coordinates of

$$\begin{aligned}y(558) &= 0.095340 \text{ rad} \\ x(1539) &= -0.024052 \text{ rad}\end{aligned}$$

#### **4.2.8.2 Navigating from Geodetic Latitude ( $\phi$ ) and Longitude ( $\lambda$ ) to N/S Elevation Angle (y) and E/W Scanning Angle (x)**

Given a point P on the GRS80 ellipsoid with geodetic  $(\phi, \lambda)$  coordinates find the fixed grid  $(y, x)$  coordinates.

Note that if the following inequality is true, then the  $(\phi, \lambda)$  location is not visible from the satellite and the elevation and scanning angles should not be computed.

$$H(H - s_x) < s_y^2 + \frac{r_{eq}^2}{r_{pol}^2} s_z^2$$

The N/S Elevation Angle (y) and E/W Scanning Angle (x) are computed by the following equations:

$$\begin{pmatrix} y \\ x \end{pmatrix} = \begin{pmatrix} \arctan\left(\frac{s_z}{s_x}\right) \\ \arcsin\left(\frac{-s_y}{\sqrt{s_x^2 + s_y^2 + s_z^2}}\right) \end{pmatrix}$$

Where,

$\phi$  = GRS80 geodetic latitude in radians

$\lambda$  = GRS80 longitude in radians

$$\phi_C = \arctan\left(\frac{r_{pol}^2}{r_{eq}^2} \tan(\phi)\right) \text{ geocentric latitude}$$

$$r_c = \frac{r_{pol}}{\sqrt{1 - e^2 \cos^2(\phi_C)}} \text{ geocentric distance to the point on the ellipsoid}$$

$$\begin{pmatrix} s_x \\ s_y \\ s_z \end{pmatrix} = \begin{pmatrix} H - r_c \cos(\phi_C) \cdot \cos(\lambda - \lambda_0) \\ -r_c \cos(\phi_C) \cdot \sin(\lambda - \lambda_0) \\ r_c \sin(\phi_C) \end{pmatrix}$$

### Example

This example verifies that the algorithm defined in paragraph 4.1.2.8.1 has an inverse. This example is based on the GOES-R east satellite for a point, P, in a 2 km CONUS product with geodetic latitude and longitude given by

$$\phi = 33.846162 \text{ deg} = 0.590726966 \text{ rad}$$

$$\lambda = -84.690932 \text{ deg} = -1.47813561 \text{ rad}$$

Values for the parameters used in the equations and their netCDF Product File Attribute Names described in the table immediately above are as follows:

$$r_{eq} = \text{goes\_imagery\_projection:semi\_major\_axis} = 6378137 \text{ (meters)}$$

$$I/f = \text{goes\_imagery\_projection:inverse\_flattening} = 298.257222096$$

$$r_{pol} = \text{goes\_imagery\_projection:semi\_minor\_axis} = 6356752.31414 \text{ (meters)}$$

$$e = 0.0818191910435$$

$$\text{goes\_imagery\_projection:perspective\_point\_height} = 35786023 \text{ (meters)}$$

$$H = \text{goes\_imagery\_projection:perspective\_point\_height} + \text{goes\_imagery\_projection:semi\_major\_axis} = 42164160 \text{ (meters)}$$

$$\phi = 0.590726966$$

$$\lambda = -1.47813561$$

$$\begin{aligned} \lambda_0 &= \text{goes\_imagery\_projection:longitude\_of\_projection\_origin} \\ &= -1.308996939 \end{aligned}$$

Based on these input values, the intermediate calculations in the above equations yield the following:

$$\phi_C = 0.587623849$$

$$r_c = 6371541.614$$

$$s_x = 36937048.71$$

$$s_y = 892635.07$$

$$s_z = 3532287.186$$

Now using the values specified above and substituting into the equations for y and x, we obtain the following for the fixed grid coordinates

$$y = 0.095340 \text{ rad}$$

$$x = -0.024052 \text{ rad}$$

corresponding to the GOES-R east satellite geodetic latitude and longitude of

$$\phi = 33.846162 \text{ deg}$$

$$\lambda = -84.690932 \text{ deg}$$

#### 4.2.9 Overlays Data from Different Image Types

GOES-R ABI Level 1b and ABI Level 2+ product data users will need to overlay full disk, CONUS, and mesoscale products for data processing and display purposes.

The netCDF coordinate variables contain the ABI fixed grid coordinates, E/W scanning angle and N/S elevation angle that correspond to each point in the data variable. However, the array subscripts for a netCDF data variable are relative to the most northwest data point in the particular product file.

When the resolutions of the products are the same, the following equation allows one to map the data variable array subscripts from the product containing the geographically smaller region to the product containing the geographically larger region. Note that the data variable array element (0,0) corresponds to the most northwest data point in the image data.

$$\hat{Y}_L = (^{FG}Y_L - ^{FG}Y_S) / \alpha$$

$$\hat{X}_L = (^{FG}X_S - ^{FG}X_L) / \alpha$$

where,

$^{FG}Y_S$  fixed grid N/S elevation angle in radians for smaller region's northwest data point

$^{FG}X_S$  fixed grid E/W scanning angle in radians for smaller region's northwest data point

$^{FG}Y_L$  fixed grid N/S elevation angle in radians for larger region's northwest data point

$^{FG}X_L$  fixed grid E/W scanning angle in radians for larger region's northwest data point

$\alpha$  horizontal spatial resolution of the data in radians

$\hat{X}_L$  larger region's data variable x-axis subscript for smaller region's northwest data point

$\hat{Y}_L$  larger region's data variable y-axis subscript for smaller region's northwest data point

In the case where the resolution of the products being overlaid is not the same, the same general thinking applies, except " $\alpha$ " needs to be the horizontal spatial resolution of the data in radians for the geographically larger product, and the application will need to deal with incongruities caused by the differing resolutions of the products.

#### Example

This example shows how a 2 km CONUS product can be overlaid on a 2 km Full Disk product from the GOES-R East satellite at -75 degrees east longitude.

Table 4.2.9 captures the parameters required.

**Table 4.2.9 Parameters for 2 km CONUS Product Overlay on 2 km Full Disk Product**

Parameter Name	netCDF Product Variable / Attribute Name	Value (radians)
$^{FG}Y_{CONUS}$	CONUS coordinate variable y(0)	0.126588
$^{FG}X_{CONUS}$	CONUS coordinate variable x(0)	-0.110236
$^{FG}Y_{FullDisk}$	Full Disk coordinate variable y(0)	0.151844
$^{FG}X_{FullDisk}$	Full Disk coordinate variable x(0)	-0.151844
$\alpha$	CONUS product file <primary data variable>:resolution	0.000056

Using the equations defined above:

$$\hat{Y}_{FullDisk} = (^{FG}Y_{FullDisk} - ^{FG}Y_{CONUS}) / \alpha = (0.151844 - 0.126588) / 0.000056 = 451$$

$$\hat{X}_{FullDisk} = (^{FG}X_{CONUS} - ^{FG}X_{FullDisk}) / \alpha = (-0.110236 - -0.151844) / 0.000056 = 743$$

Therefore:

- (1) Full Disk location for coordinate variable y(451) and x(743) is same location as CONUS coordinate variable y(0) and x(0)
- (2) <DataVariable> Full Disk (451,743) is same location as <DataVariable> CONUS (0,0)

#### 4.3 Global Latitude/Longitude Grid

\*\*\* This paragraph will be supplied in PUG version C.2. \*\*\*

##### 4.3.1 Common Level 2+ Product Coordinates

Coordinates are included in the product files, and provide the capability to locate individual product data values in space and time. Space not only refers to physical location but can refer to wavelength within the electromagnetic spectrum, atmospheric pressure levels, location relative to sun or the sensing platform, and other points of reference meaningful to the particular data quantity. Coordinates are described in detail in the CF Metadata Conventions section in the main volume of the PUG.

Table 4.3.1, Common Level 2+ Product Coordinates identifies and describes coordinates common to multiple ABI Level 2+ products.

**Table 4.3.1 Common Level 2+ Product Coordinates**

Coordinate	Description
Geo-location coordinates	The geo-location coordinates for product data points on the ABI fixed grid are the N/S elevation and E/W scanning angles stored in variables "y" and "x", respectively. A mapping to latitude and longitude coordinates is required. Refer to the paragraph 4.1.2 ABI Fixed Grid, for

Coordinate	Description
	<p>additional details.</p> <p>The geo-location coordinates for product-level metadata on the ABI fixed grid, such as the roll-up statistics associated with the gridded data, are the N/S elevation and E/W scanning angles for the center of the product and its bounding rectangle. These coordinate values are stored in variables “y_image”, “x_image”, “y_image_bounds”, and “x_image_bounds”.</p> <p>The geo-location coordinates for product data points not on the ABI fixed grid are latitude and longitude coordinates. These coordinate values are stored in variables “y” and “x”, respectively.</p> <p>The geo-location coordinates for product-level metadata not on the ABI fixed grid, such as the roll-up statistics associated with the Derived Motion Winds product, are the latitude and longitude for the center of the product and its bounding rectangle. These coordinate values are stored in variables “y_image”, “x_image”, “y_image_bounds”, and “x_image_bounds”.</p>
Time of observation	The time coordinates for the product data and metadata are the mid-point, and start and end time of the sensing period for the product. These coordinate values are stored in variables “t” and “time_bounds”.
Band center wavelength and identifier	The band center wavelength and corresponding band identifier where applicable for wavelength dependent data quantities. These coordinate values are stored in variables “band_wavelength” and “band_id”, respectively.
Satellite zenith angle	There are some Level 2+ products where the angle between the line of sight to the satellite and the local zenith at the observation target has an adverse effect on the quality of product data or precludes its generation. The satellite zenith angle coordinates identify the specific angular constraints. These coordinate values are stored in variables “satellite_z zenith_angle” and “satellite_z zenith_angle_bounds”.
Solar zenith angle	There are some Level 2+ products where the angle between the line of sight to the sun and the local zenith at the observation target has an adverse effect on the quality of product data or precludes its generation. This coordinate is also used to indicate day-only product data. These coordinate values are typically stored in variables “solar_z zenith_angle” and “solar_z zenith_angle_bounds”.

### 4.3.2 Common Level 2+ Product Data Quality Flag Variables

A data quality flag provides one or more indicators of quality. It is associated with:

- Each data point in the case of an ABI Level 2+ gridded product.
- Each wind vector or hurricane intensity estimate in the case of the Derived Motion Winds and Hurricane Intensity Estimate products, respectively.
- Each Lightning Detection product flash and constituent group.

The dimensions of the variable containing the data quality flags mirror that of the variable containing the data. The relationship between the data variable and the data quality flag variable is expressed by attaching the attribute ancillary\_variables to the data variable in accordance with the CF metadata

conventions. The value of this attribute is the name of the variable containing the data quality flags, usually DQF unless the product file contains multiple DQF variables.

The possible values assigned to a data quality flag vary for each Level 2+ product. This is a result of the different science and boundary conditions associated with each Level 2+ algorithm. Some products include one indication of quality while others include multiple. The CF metadata convention attributes flag\_values, flag\_mask, and flag\_meanings are used to express the data quality flag values and their meaning. Refer to the CF Metadata Conventions paragraph in the main PUG volume for additional details.

#### **4.3.3 Common Level 2+ Product Statistics**

The Level 2+ products contain data transmission error statistics that provide a summary level indication of the availability of error-free source data required for the generation of the product.

The Level 2+ products contain the percentage of data elements (e.g. gridded data points, etc.) associated with each data quality flag value. Note that the value of the denominator used in calculating this percentage is the number of data elements where source data is available. For example, in the case, of ABI Level 2+ gridded products, the value of the denominator is the number of source ABI Level 1b data points that are not missing/geo-located.

The ABI Level 2+ products contain the minimum, maximum, mean, and standard deviation of the values associated with their primary data elements. The specific product data elements used in the determination of these statistics varies among the different products. What specific data elements are used is expressed in the attribute cell\_methods attached to the statistic data variables.

### **5.0 LEVEL 2+ PRODUCT AND DATA DESCRIPTIONS**

This section of the document describes, and defines the detailed content and format of the GOES-R Level 2+ product files.

Tables are used to communicate the detailed content. For netCDF product files, one table defines the global attributes in the file, and another table defines the variables and the variables' attributes. By default, in the product tables included in the volume, the values of variables are dynamic and the values of attributes are static. However, there are situations when an attribute value is selected from a list of valid values, has a fixed format, or is a dynamic value. Furthermore, there are situations where a variable or attribute value contains geospatial coordinates, dimensioning information related to coverage areas and resolution, or band dependent values. For all these cases, ***bold italic text*** is used to convey how to properly interpret what the value of the variable or attribute should be.

#### **5.1 Cloud and Moisture Imagery Product**

##### **5.1.1 Description**

The Cloud and Moisture Imagery Product represents ABI Earth-view imagery as “brightness values” that are scaled to support visual analysis. All 16 bands provided by the ABI are associated with the Cloud and Moisture Imagery product. Both single band and multi-band product files are generated.

Imagery for the reflective bands (1-6) is proportional to the “reflectance factor” and supports the characterization of clouds, vegetation, snow/ice, and aerosols. Imagery for the emissive bands (7-16) is proportional to brightness temperature and supports the characterization of surface, cloud, water vapor, ozone, volcanic ash and dust based on thermal properties. The brightness values may be used individually with custom color tables or combined as red/green/blue color composites resulting to enhanced imagery intended to highlight environmental features of interest.

The brightness value bit depth for all bands is 12 bits with the exception of band 7, which is 14 bits. This brightness value is stored as a scaled 16 bit integer. A user of the imagery product can apply enhancements to convert the product for display on a given system (e.g., on a 24-bit RGB display). For example, square-root function or bi-linear stretch can be included in the transformation of the brightness values from 12/14 bits to 8 bits. The conversion from brightness values to reflectance factor or brightness temperature is provided by the data variable's attributes "scale\_factor" and "add\_offset". Other product metadata define the quantities and their values used in the conversion of Radiances to reflectance factor or brightness temperature.

A per-band data quality flag (DQF) is provided with the product that identifies each pixel in the product as "good", "conditionally useable", "saturated", or "missing". A conditionally usable pixel means less than the full complement of 16 radiometrically corrected data samples but at least 12 data samples are used in the formulation of the pixel value. Note that pixels can either be over-saturated or under-saturated. The valid range of pixel values are located in Table 5.1.6.4, Cloud and Moisture Imagery Quantity Characteristics. Saturated pixels are assigned the minimum or maximum value in the valid range. Product metadata is included to characterize the statistical properties of the imagery. Table 5.1.1 identifies the bands, and their central wavelength, native horizontal spatial resolution, and primary use.

The Cloud and Moisture Imagery Product is provided both at the native resolution of each band (i.e., 0.5, 1.0, or 2.0 km at nadir) and as a multi-band product where the imagery at all bands are at 2.0 km resolution. For multi-band imagery, higher resolution bands are aggregated to 2.0 km using one of two possible approaches: "sub-sampling" or "spatial-averaging", which is determined by a ground system processing parameter. The Cloud and Moisture Imagery product data is on the ABI Fixed Grid. Product files are provided for Full Disk, CONUS, and Mesoscale coverage regions.

**Table 5.1.1 Primary Use of Cloud and Moisture Imagery**

ABI Band	Central Wavelength (μm)	Native Resolution (km at nadir)	Primary Use
1	0.47	1	Daytime aerosol over land, coastal water mapping.
2	0.64	0.5	Daytime clouds, fog, insolation, winds.
3	0.865	1	Daytime vegetation, burn scar, aerosol over water, winds.
4	1.378	2	Daytime cirrus cloud.
5	1.61	1	Daytime cloud-top phase and particle size, snow.
6	2.25	2	Daytime land, cloud properties, particle size, vegetation, snow.
7	3.9	2	Surface and cloud, fog at night, fire, winds.
8	6.185	2	High-level atmospheric water vapor, winds, rainfall.
9	6.95	2	Midlevel atmospheric water vapor, winds, rainfall.
10	7.34	2	Lower-level water vapor, winds, and SO <sub>2</sub> .
11	8.5	2	Total water for stability, cloud phase, dust SO <sub>2</sub> , rainfall.
12	9.61	2	Total ozone, turbulence, winds.
13	10.35	2	Surface and clouds.
14	11.2	2	Imagery, sea surface temperature, clouds, rainfall.
15	12.3	2	Total water, volcanic ash, sea surface temperature.
16	13.3	2	Air temperature, cloud heights.

The bit depth of the source L1b Radiances product for the Cloud and Moisture Imagery product, 10 to 14 bits, is band dependent and is related to the bit depth of the original down-linked samples and optimized

to support its transmission through GRB. However, different scale factors are used for Cloud and Moisture Imagery product data such that all bands are 12 bits except for band 7, which is 14 bits.

The detailed description of the ISO series metadata for the Cloud and Moisture Imagery product is located in the standalone Appendix X, ISO Series Metadata.

### **5.1.2 Dynamic Source Data**

The Cloud and Moisture Imagery product is derived from the ABI Level 1b product, Radiances, and scaled to reflective bands (1-6) based on the incoming top-of-atmosphere solar radiance or to brightness temperature for the emissive bands (7-16). Conversion of the reflective bands depends on the solar radiance at the Earth-Sun distance at the time of observation. The inverse of the solar radiance is represented by the “*kappa0*” variable in the product file. The Radiances product DQF is used by the Cloud and Moisture Imagery algorithm to account for missing pixels to assign DQF values to the corresponding pixels in the imagery product, and during the aggregation to 2 km required for the multi-band product.

### **5.1.3 Static Source Data**

For the reflective bands, algorithm processing parameters used to generate the imagery product include the solar irradiance for each band. Note that the dynamic source data parameter, “*kappa0*”, accounts for this reflective band-specific solar irradiance parameter. For the emissive bands, the conversion to brightness temperature is achieved through the application of coefficients “*planck\_fk1*” and “*planck\_fk2*” used to convert monochromatic radiance to brightness temperature based on the Planck function. In addition, coefficients “*planck\_bc1*” and “*planck\_bc2*” are spectral bandpass offset and scale factor correction terms. Latitude, longitude, and an off-earth pixel mask on the ABI Fixed Grid are used in the multi-band product aggregation process.

**\*\*\*Additional information will be supplied in PUG version D. \*\*\***

### **5.1.4 Coordinates**

The coordinates associated with data variables in the Cloud and Moisture Imagery product are identified in Table 5.1.4, Cloud and Moisture Imagery Product Coordinates.

**Table 5.1.4 Cloud and Moisture Imagery Product Coordinates**

<b>Cloud and Moisture Imagery Product Data Quantity</b>	<b>Coordinates</b>
Cloud and moisture imagery and DQF data	<ul style="list-style-type: none"> <li>Central wavelength and identifier of the ABI band</li> <li>Time of observation</li> <li>N/S elevation and E/W scanning angles (geolocation)</li> </ul>
Product summary pixel count fields	
Product summary statistics	
Solar irradiance (esun)	<ul style="list-style-type: none"> <li>Central wavelength and identifier of the ABI band</li> <li>Time of observation</li> </ul>
Inverse of the incoming top of atmosphere radiance ( <i>kappa0</i> )	
Planck constants	<ul style="list-style-type: none"> <li>Central wavelength and identifier of the ABI band</li> </ul>
Earth – sun distance anomaly	<ul style="list-style-type: none"> <li>Time of observation</li> </ul>
Data transmission errors	<ul style="list-style-type: none"> <li>Time of observation</li> <li>N/ S elevation and E/W scanning angles (geolocation)</li> </ul>

### 5.1.5 Production Notes

The Cloud and Moisture Imagery product is generated by the GOES-R Cloud and Moisture Imagery ground-processing algorithm. Each band is processed as an independent product file. The algorithm computes reflectance factor and brightness temperature as floating point values and the final scaled product is created when the product file is assembled. The product is not normalized by the solar zenith angle. The dynamic range of the reflectance and brightness temperature output is not constrained by the algorithm but it is compared to the expected measurement range for each band based on the sensor dynamic range. The number of outliers relative to this expected range for a given product is reported.

The floating point product data is converted to 16 bit scaled integer values. Out-of-range values are truncated at the minimum or maximum of the product data valid range. Calculations are performed for all pixels not identified as "missing" based on the source Radiances product DQF. The Cloud and Moisture Imagery product DQF is identical to the Radiances product DQF. Product values derived based on "saturated" pixels are identified as "saturated". Pixels not processed are assigned a DQF or "missing" and fill values are assigned to the product. If input L1b data is not available for some portion of a scene, the affected pixels are flagged as "missing" and the fill values are assigned to the imagery. The Cloud and Moisture Imagery algorithm also supports the generation of intermediate reflectance and brightness temperature products used in the generation of other Level 2+ products.

The Cloud and Moisture Imagery product is generated for each observation by the instrument. Refer to Appendix B, Product Refresh Rates and Latencies.

NOAA NESDIS Center for Satellite Applications and Research GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document For Cloud and Moisture Imagery Product (CMIP). This document is located at [http://www.goes-r.gov/products/ATBDs/baseline/Imagery\\_v2.0\\_no\\_color.pdf](http://www.goes-r.gov/products/ATBDs/baseline/Imagery_v2.0_no_color.pdf).

### 5.1.6 Data Fields

The Cloud and Moisture Imagery product file uses the netCDF-4 file format. The specifications for the reflective and emissive bands are different, and, as a result, separate tables are used to convey their content. In addition there is a metadata in the Cloud and Moisture Imagery product related to the physical quantity that varies as a function of the band. The subordinate paragraphs that follow include tables for the product's reflective and emissive bands, the multi-band product, the physical quantity characteristics that vary as a function of the band, and the DQF variable flag values and meanings.

The filename conventions for the Cloud and Moisture Imagery product is located in Appendix A.

### 5.1.6.1 Reflective Bands Data Fields

**Table 5.1.6.1-1 Cloud and Moisture Imagery for Reflective Bands: Global Attributes**

Name	Value	Type
Id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
naming_authority	gov.nesdis.noaa	string
Institution	DOC/NOAA/NESDIS> U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Services	string
Project	GOES	string
iso_series_metadata_id	8c9e8150-3692-11e3-aa6e-0800200c9a66	string
Conventions	CF-1.7	string
Metadata_Conventions	Unidata Dataset Discovery v1.0	string
keywords_vocabulary	NASA Global Change Master Directory (GCMD) Earth Science Keywords, Version 7.0.0.0.0	string
standard_name_vocabulary	CF Standard Name Table (v25, 05 July 2013)	string
Title	ABI L2 Cloud and Moisture Imagery	string
Summary	Single reflective band Cloud and Moisture Imagery Products are digital maps of clouds, moisture, and atmospheric windows at visible and near-IR bands.	string
License	Unclassified data. Access is restricted to approved users only.	string
Keywords	ATMOSPHERE > ATMOSPHERIC RADIATION > REFLECTANCE, SPECTRAL/ENGINEERING > VISIBLE WAVELENGTHS > REFLECTANCE	string
cdm_data_type	Image	string
orbital_slot	<i>possible values are GOES-East, GOES-West, GOES-Test, and GOES-Storage.</i>	string
platform_ID	<i>possible values are G16 and G17.</i>	string
instrument_type	GOES R Series Advanced Baseline Imager	string
instrument_ID	<i>serial number of the instrument.</i>	string
processing_level	National Aeronautics and Space Administration (NASA) L2	string
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	NSOF	string
production_environment	<i>possible values are OE, ITE, and DE.</i>	string
production_data_source	<i>possible values are Realtime, Simulated, Playback, and Test.</i>	string

Name	Value	Type
timeline_id	<i>possible values are ABI Mode 3 and ABI Mode 4.</i>	string
scene_id	<i>possible values are Full Disk, CONUS, and Mesoscale.</i>	string
spatial_resolution	<i>possible values are 0.5km at nadir, 1km at nadir, and 2km at nadir.</i>	string
time_coverage_start	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
time_coverage_end	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string

**Table 5.1.6.1-2 Cloud and Moisture Imagery for Reflective Bands: Variables**

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
y	short	<i>y = see note [1]</i>	long_name	GOES-R fixed grid projection y-coordinate	string
			standard_name	projection_y_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string
			axis	Y	string
x	short	<i>x = see note [1]</i>	long_name	GOES-R fixed grid projection x-coordinate	string
			standard_name	projection_x_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string
			axis	X	string
t	double	n/a	long_name	J2000 epoch mid-point between the start and end image scan in seconds	string
			standard_name	time	string
			units	seconds since 2000-01-01 12:00:00	string
			axis	T	string
			bounds	time_bounds	string
time_bounds	double	number_of_time_bounds	long_name	Scan start and end times in seconds since epoch (2000-01-01 12:00:00)	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
		= 2			
band_wavelength <i>value = see note [2]</i>	float	band = 1	long_name	ABI band central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_id <i>value = see note [2]</i>	byte	band = 1	long_name	ABI channel number	string
			standard_name	sensor_band_identifier	string
			units	1	string
y_image <i>value = see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection y-coordinate center of image	string
			standard_name	projection_y_coordinate	string
			units	rad	string
			axis	Y	string
			bounds	y_image_bounds	string
y_image_bounds <i>value = see note [1]</i>	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection y-coordinate north/south extent of image	string
x_image <i>value = see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection x-coordinate center of image	string
			standard_name	projection_x_coordinate	string
			units	rad	string
			axis	X	string
			bounds	x_image_bounds	string
x_image_bounds <i>value = see note [1]</i>	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection x-coordinate west/east extent of image	string
goes_imager_projection	int	n/a	long_name	GOES-R ABI fixed grid projection	string
			grid_mapping_name	geostationary	string
			perspective_point_height	35786023	double
			semi_major_axis	6378137	double

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI	short	<i>y = see note [1]</i>  <i>x = see note [1]</i>	semi_minor_axis	6356752.314	double
			inverse_flattening	298.2572221	double
			latitude_of_projection_origin	0	double
			longitude_of_projection_origin	<i>see note [1]</i>	double
			sweep_angle_axis	x	string
DQF	byte	<i>y = see note [1]</i>  <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by cosine_solar zenith_angle	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	<i>see note [2]</i>	byte
			valid_range	<i>see note [2]</i>	short
			scale_factor	<i>see note [2]</i>	float
			add_offset	<i>see note [2]</i>	float
			units	1	string
			resolution	y: see note [2] rad x: see note [2] rad	string
			coordinates	band_id band_wavelength t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			coordinates	band_id band_wavelength t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range pixel no_value pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<b>dynamic value</b>	float
			percent_conditionally_usable_pixels	<b>dynamic value</b>	float
			percent_out_of_range_pixels	<b>dynamic value</b>	float
			percent_no_value_pixels	<b>dynamic value</b>	float
total_number_of_points	int	n/a	long_name	number of geolocated/not missing pixels	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: see note [2] rad comment: geolocated/not missing pixels only)	string
valid_pixel_count	int	n/a	long_name	number of good or conditionally usable pixels	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count	int	n/a	long_name	number of good quality cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	count	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: see note [2] rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_reflectance_factor	float	n/a	long_name	minimum reflectance factor value of good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
max_reflectance_factor	float	n/a	long_name	maximum reflectance factor value of good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
mean_reflectance_factor	float	n/a	long_name	mean reflectance factor value of good or conditionally usable pixels	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar zenith angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
std_dev_reflectance_factor	float	n/a	long_name	standard deviation of reflectance factor values of good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar zenith angle	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
esun	float	n/a	long_name	bandpass-weighted solar irradiance at the mean Earth-Sun distance	string
			standard_name	toa_shortwave_irradiance_per_unit_wavelength	string
			_FillValue	-999.0	float
			units	W m-2 um-1	string
			coordinates	band_id band_wavelength t	string
			cell_methods	t: mean	string
kappa0	float	n/a	long_name	Inverse of the incoming top of atmosphere radiance at current earth-sun distance (PI d2 esun-1)-1, where d is the ratio of instantaneous Earth-Sun distance divided by the mean Earth-Sun distance, esun is the bandpass-	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
				weighted solar irradiance and PI is a standard constant used to convert ABI L1b radiance to reflectance	
			_FillValue	-999.0	float
			units	(W m-2 um-1)-1	string
			coordinates	band_id band_wavelength t	string
			cell_methods	t: mean	string
planck_fk1	float	n/a	long_name	wavenumber-dependent coefficient (2 h c2/ nu3) used in the ABI emissive band monochromatic brightness temperature computation, where nu =central wavenumber and h and c are standard constants	string
			_FillValue	-999.0	float
			units	W m-1	string
			coordinates	band_id band_wavelength	string
				wavenumber-dependent coefficient (h c nu/b) used in the ABI emissive band monochromatic brightness temperature computation, where nu = central wavenumber and h, c, and b are standard constants	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id band_wavelength	string
				spectral bandpass correction offset for brightness temperature (B(nu) – bc_1)/bc_2 where B()=planck_function() and nu=wavenumber	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id band_wavelength	string
				spectral bandpass correction scale factor for brightness temperature (B(nu) – bc_1)/bc_2 where B()=planck_function() and nu=wavenumber	string
			_FillValue	-999.0	float
			units	1	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
earth_sun_distance_anomaly_in_AU	float	n/a	coordinates	band_id band_wavelength	string
			long_name	earth sun distance anomaly in astronomical units	string
			_FillValue	-999.0	float
			units	ua	string
			coordinates	t	string
			cell_methods	t: mean	string
percent_uncorrectable_GRB_errors	float	n/a	long_name	percent data lost due to uncorrectable GRB errors	string
			_FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (uncorrectable GRB errors only)	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (uncorrectable L0 errors only)	string
nominal_satellite_subpoint_lat <b>value = 0.00</b>	float	n/a	long_name	nominal satellite subpoint latitude (platform latitude)	string
			standard_name	latitude	string
			_FillValue	-999.0	float
			units	degrees_north	string
nominal_satellite_subpoint_lon <b>value = see note [1]</b>	float	n/a	long_name	nominal satellite subpoint longitude (platform longitude)	string
			standard_name	longitude	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
nominal_satellite_height  <i>value = 35786.023</i>	float	n/a	_FillValue	-999.0	float
			units	degrees_east	string
			long_name	nominal satellite height above GRS 80 ellipsoid (platform altitude)	string
			standard_name	height_above_reference_ellipsoid	string
			_FillValue	-999.0	float
geospatial_lat_lon_extent	float	n/a	units	km	string
			long_name	geospatial latitude and longitude references	string
			geospatial_westbound_longitude	<i>see note [1]</i>	float
			geospatial_northbound_latitude	<i>see note [1]</i>	float
			geospatial_eastbound_longitude	<i>see note [1]</i>	float
			geospatial_southbound_latitude	<i>see note [1]</i>	float
			geospatial_lat_center	<i>see note [1]</i>	float
			geospatial_lon_center	<i>see note [1]</i>	float
			geospatial_lat_nadir	0.0	float
			geospatial_lon_nadir	<i>see note [1]</i>	float
algorithm_dynamic_input_data_container	int	n/a	geospatial_lat_units	degrees_north	string
			geospatial_lon_units	degrees_east	string
			long_name	container for filenames of dynamic algorithm input data	string
processing_parm_version_container	int	n/a	input_ABI_L2_auxiliary_data	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
			input_ABI_L1b_radiance_band_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
algorithm_product_version_container	int	n/a	long_name	container for processing parameter filenames	string
				container for algorithm package filename and product version	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			algorithm_version	<i>refer to filename conventions for L2+ algorithm packages in Appendix A.</i>	string
			product_version	<i>format is vVRR where VV is major release # and RR is minor revision #.</i>	string

Note 1: Coverage region and horizontal spatial resolution related sizing and extent variable and attribute values are located in paragraph 4.2.6, Product Data Structures, and paragraph 4.2.7, Standard Coordinate Data, in the ABI Fixed Grid section.

Note 2: Cloud and Moisture Imagery quantity characteristics are located in paragraph 5.1.6.4, Cloud and Moisture Imagery Quantity Characteristics.

Note 3: Flag values and meanings are located in paragraph 5.1.6.5, Cloud and Moisture Imagery Data Qualtiy Values and Meanings.

### 5.1.6.2 Emissive Bands Data Fields

**Table 5.1.6.2-1 Cloud and Moisture Imagery for Emissive Bands: Global Attributes**

Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string
dataset_name	<i>refer to filename conventions for ABI L2+ products in Appendix A.</i>	string
naming_authority	gov.nesdis.noaa	string
institution	DOC/NOAA/NESDIS> U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Services	string
project	GOES	string
iso_series_metadata_id	8c9e8150-3692-11e3-aa6e-0800200c9a66	string
Conventions	CF-1.7	string
Metadata_Conventions	Unidata Dataset Discovery v1.0	string
keywords_vocabulary	NASA Global Change Master Directory (GCMD) Earth Science Keywords, Version 7.0.0.0.0	string
standard_name_vocabulary	CF Standard Name Table (v25, 05 July 2013)	string
title	ABI L2 Cloud and Moisture Imagery	string
summary	Single emissive band Cloud and Moisture Imagery Products are digital maps of clouds, moisture, and atmospheric windows at IR bands.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	SPECTRAL/ENGINEERING > INFRARED WAVELENGTHS > BRIGHTNESS TEMPERATURE	string
cdm_data_type	Image	string

Name	Value	Type
orbital_slot	<i>possible values are GOES-East, GOES-West, GOES-Test, and GOES-Storage.</i>	string
platform_ID	<i>possible values are G16 and G17.</i>	string
instrument_type	GOES R Series Advanced Baseline Imager	string
instrument_ID	<i>serial number of the instrument.</i>	string
processing_level	National Aeronautics and Space Administration (NASA) L2	string
date_created	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
production_site	NSOF	string
production_environment	<i>possible values are OE, ITE, and DE.</i>	string
production_data_source	<i>possible values are Realtime, Simulated, Playback, and Test.</i>	string
timeline_id	<i>possible values are ABI Mode 3 and ABI Mode 4.</i>	string
scene_id	<i>possible values are Full Disk, CONUS, and Mesoscale.</i>	string
spatial_resolution	<i>possible values are 0.5km at nadir, 1km at nadir, and 2km at nadir.</i>	string
time_coverage_start	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
time_coverage_end	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string

**Table 5.1.6.2-2 Cloud and Moisture Imagery for Emissive Bands: Variables**

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
y	short	<i>y = see note [1]</i>	long_name	GOES-R fixed grid projection y-coordinate	string
			standard_name	projection_y_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string
			axis	Y	string
x	short	<i>x = see note [1]</i>	long_name	GOES-R fixed grid projection x-coordinate	string
			standard_name	projection_x_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
t	double	n/a	axis	X	string
			long_name	J2000 epoch mid-point between the start and end image scan in seconds	string
			standard_name	time	string
			units	seconds since 2000-01-01 12:00:00	string
			axis	T	string
time_bounds	double	number_of_time_bounds = 2	bounds	time_bounds	string
			long_name	Scan start and end times in seconds since epoch (2000-01-01 12:00:00)	string
band_wavelength <i>value = see note [2]</i>	float	band = 1	long_name	ABI band central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_id <i>value = see note [2]</i>	byte	band = 1	long_name	ABI band number	string
			standard_name	sensor_band_identifier	string
			units	l	string
y_image <i>value = see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection y-coordinate center of image	string
			standard_name	projection_y_coordinate	string
			units	rad	string
			axis	Y	string
			bounds	y_image_bounds	string
y_image_bounds <i>value = see note [1]</i>	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection y-coordinate north/south extent of image	string
			standard_name	projection_y_extent	string
x_image <i>value = see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection x-coordinate center of image	string
			standard_name	projection_x_coordinate	string
			units	rad	string
			axis	X	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			bounds	x_image_bounds	string
x_image_bounds  value = <i>see note [1]</i>	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection x-coordinate west/east extent of image	string
goes_imager_projection	int	n/a	long_name	GOES-R ABI fixed grid projection	string
			grid_mapping_name	geostationary	string
			perspective_point_height	35786023	double
			semi_major_axis	6378137	double
			semi_minor_axis	6356752.314	double
			inverse_flattening	298.2572221	double
			latitude_of_projection_origin	0	double
			longitude_of_projection_origin	<i>see note [1]</i>	double
			sweep_angle_axis	x	string
CMI	short	<i>y = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
		<i>x = see note [1]</i>	standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	<i>see note [2]</i>	byte
			valid_range	<i>see note [2]</i>	short
			scale_factor	<i>see note [2]</i>	float
			add_offset	<i>see note [2]</i>	float
			units	K	string
			resolution	y: <i>see note [2]</i> rad x: <i>see note [2]</i> rad	string
			coordinates	band_id band_wavelength t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
DQF	byte	<i>y = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id band_wavelength t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
total_number_of_points	int	n/a	long_name	number of geolocated/not missing pixels	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: see note [2] rad comment: geolocated/not missing pixels only)	string
valid_pixel_count	int	n/a	long_name	number of good or conditionally usable pixels	string
			_FillValue	-1	int
			units	count	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count	int	n/a	long_name	number of good quality cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: see note [2] rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature	float	n/a	long_name	minimum top of atmosphere brightness temperature value of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
max_brightness_temperature	float	n/a	long_name	maximum top of atmosphere brightness temperature value of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature	float	n/a	long_name	mean top of atmosphere brightness temperature value of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature	float	n/a	long_name	standard deviation of top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id band_wavelength t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: see note [2] rad comment: good or conditionally usable quality pixels only)	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
esun	float	n/a	long_name	bandpass-weighted solar irradiance at the mean Earth-Sun distance	string
			standard_name	toa_shortwave_irradiance_per_unit_wavelength	string
			_FillValue	-999.0	float
			units	W m-2 um-1	string
			coordinates	band_id band_wavelength t	string
			cell_methods	t: mean	string
kappa0	float	n/a	long_name	Inverse of the incoming top of atmosphere radiance at current earth-sun distance (PI d2 esun-1)-1, where d is the ratio of instantaneous Earth-Sun distance divided by the mean Earth-Sun distance, esun is the bandpass-weighted solar irradiance and PI is a standard constant used to convert ABI L1b radiance to reflectance	string
			_FillValue	-999.0	float
			units	(W m-2 um-1)-1	string
			coordinates	band_id band_wavelength t	string
			cell_methods	t: mean	string
			long_name	wavenumber-dependent coefficient (2 h c2/ nu3) used in the ABI emissive band monochromatic brightness temperature computation, where nu = central wavenumber and h and c are standard constants	string
planck_fk1	float	n/a	_FillValue	-999.0	float
			units	W m-1	string
			coordinates	band_id band_wavelength	string
			long_name	wavenumber-dependent coefficient (h c nu/b) used in the ABI emissive band monochromatic brightness temperature computation, where nu = central wavenumber and h, c, and b are standard constants	string
planck_fk2	float	n/a			

Variable			Attribute				
Name	Type	Shape	Name	Value	Type		
planck_bc1	float	n/a	_FillValue	-999.0	float		
			units	K	string		
			coordinates	band_id band_wavelength	string		
planck_bc2	float	n/a	long_name	spectral bandpass correction offset for brightness temperature $(B(\nu) - bc\_1)/bc\_2$ where $B()=planck\_function()$ and $\nu=wavenumber$	string		
			_FillValue	-999.0	float		
			units	K	string		
earth_sun_distance_anomaly_in_AU	float	n/a	coordinates	band_id band_wavelength	string		
			long_name	spectral bandpass correction scale factor for brightness temperature $(B(\nu) - bc\_1)/bc\_2$ where $B()=planck\_function()$ and $\nu=wavenumber$	string		
			_FillValue	-999.0	float		
percent_uncorrectable_GRB_errors	float	n/a	units	1	string		
			coordinates	band_id band_wavelength	string		
			cell_methods	earth sun distance anomaly in astronomical units	string		
percent_uncorrectable_GRB_errors	float	n/a	long_name	t	string		
			_FillValue	t: mean	string		
			units	ua	string		
			coordinates	percent	string		
			cell_methods	percent data lost due to uncorrectable GRB errors	string		
			valid_range	-999.0	float		
			units	0.0 1.0	float		
			coordinates	percent	string		
			grid_mapping	t y_image x_image	string		
			grid_mapping	goes_imager_projection	string		

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	t: sum area: sum (uncorrectable GRB errors only)	string
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string
			_FillValue	-999.0	float
			valid_range	0.0 1.0	float
			units	percent	string
			coordinates	t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (uncorrectable L0 errors only)	string
nominal_satellite_subpoint_lat  <i>value = 0.00</i>	float	n/a	long_name	nominal satellite subpoint latitude (platform latitude)	string
			standard_name	latitude	string
			_FillValue	-999.0	float
			units	degrees_north	string
nominal_satellite_subpoint_lon  <i>value = see note [1]</i>	float	n/a	long_name	nominal satellite subpoint longitude (platform longitude)	string
			standard_name	longitude	string
			_FillValue	-999.0	float
			units	degrees_east	string
nominal_satellite_height  <i>value = 35786.023</i>	float	n/a	long_name	nominal satellite height above GRS 80 ellipsoid (platform altitude)	string
			standard_name	height_above_reference_ellipsoid	string
			_FillValue	-999.0	float
			units	km	string
geospatial_lat_lon_extent	float	n/a	long_name	geospatial latitude and longitude references	string
			geospatial_westbound_longitude	<i>see note [1]</i>	float
			geospatial_northbound_latitude	<i>see note [1]</i>	float
			geospatial_eastbound_longitude	<i>see note [1]</i>	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			geospatial_southbound_latitude	<i>see note [1]</i>	float
			geospatial_lat_center	<i>see note [1]</i>	float
			geospatial_lon_center	<i>see note [1]</i>	float
			geospatial_lat_nadir	0.0	float
			geospatial_lon_nadir	<i>see note [1]</i>	float
			geospatial_lat_units	degrees_north	string
			geospatial_lon_units	degrees_east	string
algorithm_dynamic_input_data_container	int	n/a	long_name	container for filenames of dynamic algorithm input data	string
			input_ABI_L2_auxiliary_data	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
			input_ABI_L1b_radiance_band_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
processing_parm_version_container	int	n/a	long_name	container for processing parameter filenames	string
algorithm_product_version_container	int	n/a	long_name	container for algorithm package filename and product version	string
			algorithm_version	<i>refer to filename conventions for L2+ algorithm packages in Appendix A.</i>	string
			product_version	<i>format is vVVRR where VV is major release # and RR is minor revision #.</i>	string

Note 1: Coverage region and horizontal spatial resolution related sizing and extent variable and attribute values are located in paragraph 4.2.6, Product Data Structures and paragraph 4.2.7, Standard Coordinate Data, in the ABI Fixed Grid section.

Note 2: Cloud and Moisture Imagery Product quantity characteristics are located in paragraph 5.1.6.4, Cloud and Moisture Imagery Quantity Characteristics.

Note 3: Flag values and meanings are located in paragraph 5.1.6.5, Cloud and Moisture Imagery Data Qualtiy Values and Meanings.

### 5.1.6.3 Multi-Band Data Fields

**Table 5.1.6.3-1 Cloud and Moisture Imagery for Multi-band: Global Attributes**

Name	Value	Type
id	<i>universally unique identifier (UUID) for the instance of the product.</i>	string

Name	Value	Type
dataset_name	<i>refer to filename conventions for ABI L2+ products.</i>	string
naming_authority	gov.nesdis.noaa	string
institution	DOC/NOAA/NESDIS> U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Services	string
project	GOES	string
iso_series_metadata_id	8c9e8150-3692-11e3-aa6e-0800200c9a66	string
Conventions	CF-1.7	string
Metadata_Conventions	Unidata Dataset Discovery v1.0	string
keywords_vocabulary	NASA Global Change Master Directory (GCMD) Earth Science Keywords, Version 7.0.0.0.0	string
standard_name_vocabulary	CF Standard Name Table (v25, 05 July 2013)	string
title	ABI L2 Cloud and Moisture Imagery	string
summary	Multiple reflectance and emissive band Cloud and Moisture Imagery Products are digital maps of clouds, moisture, and atmospheric windows at visible, near-IR, and IR bands.	string
license	Unclassified data. Access is restricted to approved users only.	string
keywords	ATMOSPHERE > ATMOSPHERIC RADIATION > REFLECTANCE, SPECTRAL/ENGINEERING > VISIBLE WAVELENGTHS > REFLECTANCE, SPECTRAL/ENGINEERING > INFRARED WAVELENGTHS > BRIGHTNESS TEMPERATURE	string
cdm_data_type	Image	string
orbital_slot	<i>possible values are GOES-East, GOES-West, GOES-Test, and GOES-Storage.</i>	string
platform_ID	<i>possible values are G16 and G17.</i>	string
instrument_type	GOES R Series Advanced Baseline Imager	string
instrument_ID	<i>serial number of the instrument.</i>	string
processing_level	National Aeronautics and Space Administration (NASA) L2	string
date_created	<i>format is YYYY-MM-DD "T"HH:MM:SS.s "Z".</i>	string
production_site	NSOF	string
production_environment	<i>possible values are OE, ITE, and DE.</i>	string
production_data_source	<i>possible values are Realtime, Simulated, Playback, and Test.</i>	string
timeline_id	<i>possible values are ABI Mode 3 and ABI Mode 4.</i>	string

Name	Value	Type
scene_id	<i>possible values are Full Disk, CONUS, and Mesoscale.</i>	string
spatial_resolution	2km at nadir	string
time_coverage_start	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string
time_coverage_end	<i>format is YYYY-MM-DD"T"HH:MM:SS.s"Z".</i>	string

**Table 5.1.6.3-2 Cloud and Moisture Imagery for Multi-band: Variables**

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
y	short	<i>y = see note [1]</i>	long_name	GOES-R fixed grid projection y-coordinate	string
			standard_name	projection_y_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string
			axis	Y	string
x	short	<i>x = see note [1]</i>	long_name	GOES-R fixed grid projection x-coordinate	string
			standard_name	projection_x_coordinate	string
			scale_factor	<i>see note [1]</i>	float
			add_offset	<i>see note [1]</i>	float
			units	rad	string
			axis	X	string
t	double	n/a	long_name	J2000 epoch mid-point between the start and end image scan in seconds	string
			standard_name	time	string
			units	seconds since 2000-01-01 12:00:00	string
			axis	T	string
			bounds	time_bounds	string
time_bounds	double	number_of_time_bounds = 2	long_name	Scan start and end times in seconds since epoch (2000-01-01 12:00:00)	string
band_wavelength_C01 <i>value = 0.47</i>	float	band01 = 1	long_name	ABI band 1 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C02 <i>value = 0.64</i>	float	band02 = 1	long_name	ABI band 2 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
band_wavelength_C03  <b>value = 0.865</b>	float	band03 = 1	long_name	ABI band 3 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C04  <b>value = 1.378</b>	float	band04 = 1	long_name	ABI band 4 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C05  <b>value = 1.61</b>	float	band05 = 1	long_name	ABI band 5 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C06  <b>value = 2.25</b>	float	band06 = 1	long_name	ABI band 6 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C07  <b>value = 3.9</b>	float	band07 = 1	long_name	ABI band 7 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C08  <b>value = 6.185</b>	float	band08 = 1	long_name	ABI band 8 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C09  <b>value = 6.95</b>	float	band09 = 1	long_name	ABI band 9 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C10  <b>value = 7.34</b>	float	band10 = 1	long_name	ABI band 10 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C11  <b>value = 8.5</b>	float	band11 = 1	long_name	ABI band 11 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C12  <b>value = 9.61</b>	float	band12 = 1	long_name	ABI band 12 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
band_wavelength_C13 <b>value = 10.35</b>	float	band13 = 1	long_name	ABI band 13 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C14 <b>value = 11.2</b>	float	band14 = 1	long_name	ABI band 14 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C15 <b>value = 12.3</b>	float	band15 = 1	long_name	ABI band 15 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_wavelength_C16 <b>value = 13.3</b>	float	band16 = 1	long_name	ABI band 16 central wavelength	string
			standard_name	sensor_band_central_radiation_wavelength	string
			units	um	string
band_id_C01 <b>value = 1</b>	byte	band01 = 1	long_name	ABI band 1	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C02 <b>value = 2</b>	byte	band02 = 1	long_name	ABI band 2	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C03 <b>value = 3</b>	byte	band03 = 1	long_name	ABI band 3	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C04 <b>value = 4</b>	byte	band04 = 1	long_name	ABI band 4	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C05 <b>value = 5</b>	byte	band05 = 1	long_name	ABI band 5	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C06 <b>value = 6</b>	byte	band06 = 1	long_name	ABI band 6	string
			standard_name	sensor_band_identifier	string
			units	1	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
band_id_C07 <i>value = 7</i>	byte	band07 = 1	long_name	ABI band 7	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C08 <i>value = 8</i>	byte	band08 = 1	long_name	ABI band 8	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C09 <i>value = 9</i>	byte	band09 = 1	long_name	ABI band 9	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C10 <i>value = 10</i>	byte	band10 = 1	long_name	ABI band 10	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C11 <i>value = 11</i>	byte	band11 = 1	long_name	ABI band 11	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C12 <i>value = 12</i>	byte	band12 = 1	long_name	ABI band 12	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C13 <i>value = 13</i>	byte	band13 = 1	long_name	ABI band 13	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C14 <i>value = 14</i>	byte	band14 = 1	long_name	ABI band 14	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C15 <i>value = 15</i>	byte	band15 = 1	long_name	ABI band 15	string
			standard_name	sensor_band_identifier	string
			units	1	string
band_id_C16 <i>value = 16</i>	byte	band16 = 1	long_name	ABI band 16	string
			standard_name	sensor_band_identifier	string
			units	1	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
y_image value = <i>see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection y-coordinate center of image	string
			standard_name	projection_y_coordinate	string
			units	rad	string
			axis	Y	string
			bounds	y_image_bounds	string
y_image_bounds value = <i>see note [1]</i>	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection y-coordinate north/south extent of image	string
x_image value = <i>see note [1]</i>	float	n/a	long_name	GOES-R fixed grid projection x-coordinate center of image	string
			standard_name	projection_x_coordinate	string
			units	rad	string
			axis	X	string
			bounds	x_image_bounds	string
x_image_bounds value = <i>see note [1]</i>	float	number_of_image_bounds = 2	long_name	GOES-R fixed grid projection x-coordinate west/east extent of image	string
goes_imager_projection	int	n/a	long_name	GOES-R ABI fixed grid projection	string
			grid_mapping_name	geostationary	string
			perspective_point_height	35786023	double
			semi_major_axis	6378137	double
			semi_minor_axis	6356752.314	double
			inverse_flattening	298.2572221	double
			latitude_of_projection_origin	0	double
			longitude_of_projection_origin	<i>see note [1]</i>	double
			sweep_angle_axis	x	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C01	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	10	byte
			valid_range	0 4095	short
			scale_factor	0.0002442	float
			add_offset	0	float
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C01 band_wavelength_C01 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C01	string
CMI_C02	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	12	byte
			valid_range	0 4095	short
			scale_factor	0.0002442	float
			add_offset	0	float
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C02 band_wavelength_C02 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C02	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C03	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	10	byte
			valid_range	0 4095	short
			scale_factor	0.0002442	float
			add_offset	0	float
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C03 band_wavelength_C03 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C03	string
CMI_C04	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	11	byte
			valid_range	0 4095	short
			scale_factor	0.0002442	float
			add_offset	0	float
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C04 band_wavelength_C04 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C04	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C05	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	10	byte
			valid_range	0 4095	short
			scale_factor	0.0002442	float
			add_offset	0	float
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C05 band_wavelength_C05 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C05	string
CMI_C06	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	10	byte
			valid_range	0 4095	short
			scale_factor	0.0002442	float
			add_offset	0	float
			units	1	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C06 band_wavelength_C06 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C06	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C07	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	14	byte
			valid_range	0 16383	short
			scale_factor	0.00982726	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C07 band_wavelength_C07 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C07	string
CMI_C08	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	12	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C08 band_wavelength_C08 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C08	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C09	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	11	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C09 band_wavelength_C09 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C09	string
CMI_C10	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	12	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C10 band_wavelength_C10 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C10	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C11	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	12	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C11 band_wavelength_C11 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C11	string
CMI_C12	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	11	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C12 band_wavelength_C12 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C12	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C13	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	12	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C13 band_wavelength_C13 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C13	string
CMI_C14	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	12	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C14 band_wavelength_C14 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C14	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
CMI_C15	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	12	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C15 band_wavelength_C15 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C15	string
CMI_C16	short	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere	string
			standard_name	toa_brightness_temperature	string
			_Unsigned	TRUE	string
			_FillValue	65535	short
			sensor_band_bit_depth	10	byte
			valid_range	0 4095	short
			scale_factor	0.03931624	float
			add_offset	173.15	float
			units	K	string
			resolution	y: 0.000056 rad x: 0.000056 rad	string
			coordinates	band_id_C16 band_wavelength_C16 t y x	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: point area: point	string
			ancillary_variables	DQF_C16	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
DQF_C01	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C01 band_wavelength_C01 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C02	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C02 band_wavelength_C02 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C03	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C03 band_wavelength_C03 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C04	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			valid_range	0, 3	byte
			units	1	string
			coordinates	band_id_C04 band_wavelength_C04 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C05	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C05 band_wavelength_C05 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_	<i>dynamic value</i>	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
DQF_C06	byte	<i>y = see note [I]</i> <i>x = see note [I]</i>	pixels		
			percent_no_value_pixels	<b>dynamic value</b>	float
			long_name	ABI L2+ Cloud and Moisture Imagery reflectance factor data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C06 band_wavelength_C06 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<b>dynamic value</b>	float
DQF_C07	byte	<i>y = see note [I]</i> <i>x = see note [I]</i>	percent_conditionally_usable_pixels	<b>dynamic value</b>	float
			percent_out_of_range_pixels	<b>dynamic value</b>	float
			percent_no_value_pixels	<b>dynamic value</b>	float
			long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C08	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C08 band_wavelength_C08 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
DQF_C09	byte	<i>y = see note [1]</i>  <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C09 band_wavelength_C09 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C10	byte	<i>y = see note [1]</i>  <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C10 band_wavelength_C10 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C11	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C11 band_wavelength_C11 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C12	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C12 band_wavelength_C12 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float
			percent_no_value_pixels	<i>dynamic value</i>	float
DQF_C13	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C13 band_wavelength_C13 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<i>dynamic value</i>	float
			percent_conditionally_usable_pixels	<i>dynamic value</i>	float
			percent_out_of_range_pixels	<i>dynamic value</i>	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			pixels		
			percent_no_value_pixels	<b>dynamic value</b>	float
DQF_C14	byte	<i>y = see note [I]</i> <i>x = see note [I]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C14 band_wavelength_C14 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<b>dynamic value</b>	float
			percent_conditionally_usable_pixels	<b>dynamic value</b>	float
			percent_out_of_range_pixels	<b>dynamic value</b>	float
			percent_no_value_pixels	<b>dynamic value</b>	float
DQF_C15	byte	<i>y = see note [I]</i> <i>x = see note [I]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C15 band_wavelength_C15 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<b>dynamic value</b>	float
			percent_conditionally_usable_pixels	<b>dynamic value</b>	float
			percent_out_of_range_pixels	<b>dynamic value</b>	float
			percent_no_value_pixels	<b>dynamic value</b>	float
DQF_C16	byte	<i>y = see note [1]</i> <i>x = see note [1]</i>	long_name	ABI L2+ Cloud and Moisture Imagery brightness temperature at top of atmosphere data quality flags	string
			standard_name	status_flag	string
			_Unsigned	TRUE	string
			_FillValue	255	short
			valid_range	0 3	byte
			units	1	string
			coordinates	band_id_C16 band_wavelength_C16 t y x	string
			grid_mapping	goes_imager_projection	string
			flag_values	0 1 2 3	byte
			flag_meanings	good_pixel conditionally_usable_pixel out_of_range_pixel no_value_pixel	string
			number_of_qf_values	4	byte
			percent_good_pixels	<b>dynamic value</b>	float
			percent_conditionally_usable_pixels	<b>dynamic value</b>	float
			percent_out_of_range_pixels	<b>dynamic value</b>	float
			percent_no_value_pixels	<b>dynamic value</b>	float
outlier_pixel_count_C01	int	n/a	long_name	number of good quality band 1 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	count	string
			coordinates	band_id_C01 band_wavelength_C01 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.000028 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_reflectance_factor_C01	float	n/a	long_name	minimum reflectance factor value of band 1 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C01 band_wavelength_C01 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
max_reflectance_factor_C01	float	n/a	long_name	maximum reflectance factor value of band 1 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C01 band_wavelength_C01 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
mean_reflectance_factor_C01	float	n/a	long_name	mean reflectance factor value of band 1 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C01 band_wavelength_C01 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
std_dev_reflectance_fact or_C01	float	n/a	long_name	standard deviation of reflectance factor values of band 1 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	band_id_C01 band_wavelength_C01 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
outlier_pixel_count_C02	int	n/a	cell_methods	t: sum area: standard_deviation (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
			long_name	number of good quality band 2 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C02 band_wavelength_C02 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
min_reflectance_factor_C02	float	n/a	cell_methods	t: sum area: sum (interval: 0.000014 rad comment: good quality pixels whose values are outside valid measurement range only)	string
			long_name	minimum reflectance factor value of band 2 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	1	string
			coordinates	band_id_C02 band_wavelength_C02 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000014 rad comment: good or conditionally usable quality pixels only)	string
max_reflectance_factor_C02	float	n/a	long_name	maximum reflectance factor value of band 2 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C02 band_wavelength_C02 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000014 rad comment: good or conditionally usable quality pixels only)	string
mean_reflectance_factor_C02	float	n/a	long_name	mean reflectance factor value of band 2 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C02 band_wavelength_C02 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000014C01 rad comment: good or conditionally usable quality pixels only)	string
std_dev_reflectance_fact or_C02	float	n/a	long_name	standard deviation of reflectance factor values of band 2 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			_FillValue	-999.0	float
			units	1	string
			coordinates	band_id_C02 band_wavelength_C02 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000014 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C03	int	n/a	long_name	number of good quality band 3 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C03 band_wavelength_C03 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.000028 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_reflectance_factor_C03	float	n/a	long_name	minimum reflectance factor value of band 3 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C03 band_wavelength_C03 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
max_reflectance_factor_C03	float	n/a	long_name	maximum reflectance factor value of band 3 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	1	string
			coordinates	band_id_C03 band_wavelength_C03 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
mean_reflectance_factor_C03	float	n/a	long_name	mean reflectance factor value of band 3 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C03 band_wavelength_C03 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
std_dev_reflectance_fact or_C03	float	n/a	long_name	standard deviation of reflectance factor values of band 3 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	band_id_C03 band_wavelength_C03 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard deviation (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C04	int	n/a	long_name	number of good quality band 4 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C04 band_wavelength_C04 t y_image x_image	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.000056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_reflectance_factor_C04	float	n/a	long_name	minimum reflectance factor value of band 4 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C04 band_wavelength_C04 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
max_reflectance_factor_C04	float	n/a	long_name	maximum reflectance factor value of band 4 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C04 band_wavelength_C04 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_reflectance_factor_C04	float	n/a	long_name	mean reflectance factor value of band 4 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	1	string
			coordinates	band_id_C04 band_wavelength_C04 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_reflectance_fact or_C04	float	n/a	long_name	standard deviation of reflectance factor values of band 4 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	band_id_C04 band_wavelength_C04 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C05	int	n/a	long_name	number of good quality band 5 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C05 band_wavelength_C05 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.000028 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_reflectance_factor_C05	float	n/a	long_name	minimum reflectance factor value of band 5 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C05 band_wavelength_C05 t y_image x_image	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
max_reflectance_factor_C05	float	n/a	grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
			long_name	maximum reflectance factor value of band 5 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C05 band_wavelength_C05 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
mean_reflectance_factor_C05	float	n/a	long_name	mean reflectance factor value of band 5 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C05 band_wavelength_C05 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
std_dev_reflectance_fact or_C05	float	n/a	long_name	standard deviation of reflectance factor values of band 5 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith Angle	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	band_id_C05 band_wavelength_C05 t y_image x_image	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000028 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C06	int	n/a	long_name	number of good quality band 6 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C06 band_wavelength_C06 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.000056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_reflectance_factor_C06	float	n/a	long_name	minimum reflectance factor value of band 6 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C06 band_wavelength_C06 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
max_reflectance_factor_C06	float	n/a	long_name	maximum reflectance factor value of band 6 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C06 band_wavelength_C06 t y_image x_image	string
			grid_mapping	goes_imager_projection	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_reflectance_factor_C06	float	n/a	long_name	mean reflectance factor value of band 6 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	1	string
			coordinates	band_id_C06 band_wavelength_C06 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_reflectance_fact or_C06	float	n/a	long_name	standard deviation of reflectance factor values of band 6 good or conditionally usable pixels	string
			standard_name	toa_lambertian_equivalent_albedo_multiplied_by_cosine_solar Zenith_angle	string
			_FillValue	-999.0	float
			units	1	string
			coordinates	band_id_C06 band_wavelength_C06 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C07	int	n/a	long_name	number of good quality band 7 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C07 band_wavelength_C07 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
min_brightness_temperature_C07	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 7 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C07 band_wavelength_C07 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
max_brightness_temperature_C07	float	n/a	long_name	maximum top of atmosphere brightness temperature value of band 7 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C07 band_wavelength_C07 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C07	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 7 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C07 band_wavelength_C07 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temp	float	n/a	long_name	standard deviation of band 7 top of atmosphere brightness	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
erature_C07				temperature values of good or conditionally usable pixels	
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C07 band_wavelength_C07 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C08	int	n/a	long_name	number of good quality band 8 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C08 band_wavelength_C08 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C08	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 8 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C08 band_wavelength_C08 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
max_brightness_temperature_C08	float	n/a	cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
			long_name	maximum top of atmosphere brightness temperature value of band 8 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C08 band_wavelength_C08 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C08	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 8 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C08 band_wavelength_C08 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature_C08	float	n/a	long_name	standard deviation of band 8 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C08 band_wavelength_C08 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C09	int	n/a	long_name	number of good quality band 9 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C09 band_wavelength_C09 t y_image x_image	string
			grid_mapping	goes_imager_projection	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C09	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 9 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C09 band_wavelength_C09 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
max_brightness_temperature_C09	float	n/a	long_name	maximum top of atmosphere brightness temperature value of band 9 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C09 band_wavelength_C09 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C09	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 9 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C09 band_wavelength_C09 t y_image x_image	string
			grid_mapping	goes_imager_projection	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature_C09	float	n/a	long_name	standard deviation of band 9 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C09 band_wavelength_C09 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C10	int	n/a	long_name	number of good quality band 10 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C10 band_wavelength_C10 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C10	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 10 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C10 band_wavelength_C10 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
max_brightness_temperature	float	n/a	cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
			long_name	maximum top of atmosphere brightness temperature value	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
ture_C10				of band 10 good or conditionally usable pixels	
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C10 band_wavelength_C10 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C10	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 10 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C10 band_wavelength_C10 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature_C10	float	n/a	long_name	standard deviation of band 10 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C10 band_wavelength_C10 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C11	int	n/a	long_name	number of good quality band 11 cloud and moisture imagery pixels whose value is outside valid measurement range	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C11 band_wavelength_C11 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C11	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 11 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C11 band_wavelength_C11 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
max_brightness_temperature_C11	float	n/a	long_name	maximum top of atmosphere brightness temperature value of band 11 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C11 band_wavelength_C11 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C11	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 11 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C11 band_wavelength_C11 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature_C11	float	n/a	long_name	standard deviation of band 11 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C11 band_wavelength_C11 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C12	int	n/a	long_name	number of good quality band 12 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C12 band_wavelength_C12 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C12	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 12 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
max_brightness_temperature_C12	float	n/a	coordinates	band_id_C12 band_wavelength_C12 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C12	float	n/a	long_name	maximum top of atmosphere brightness temperature value of band 12 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C12 band_wavelength_C12 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
std_dev_brightness_temperature_C12	float	n/a	cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
			long_name	mean top of atmosphere brightness temperature value of band 12 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C12 band_wavelength_C12 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
			long_name	standard deviation of band 8 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C12 band_wavelength_C12 t y_image x_image	string
			grid_mapping	goes_imager_projection	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C13	int	n/a	long_name	number of good quality band 13 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C13 band_wavelength_C13 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C13	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 13 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C13 band_wavelength_C13 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
max_brightness_temperature_C13	float	n/a	long_name	maximum top of atmosphere brightness temperature value of band 13 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C13 band_wavelength_C13 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
mean_brightness_temperature_C13	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 13 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C13 band_wavelength_C13 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature_C13	float	n/a	long_name	standard deviation of band 13 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C13 band_wavelength_C13 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C14	int	n/a	long_name	number of good quality band 14 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C14 band_wavelength_C14 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C14	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 14 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C14 band_wavelength_C14 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
max_brightness_temperature_C14	float	n/a	long_name	maximum top of atmosphere brightness temperature value of band 14 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C14 band_wavelength_C14 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C14	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 14 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C14 band_wavelength_C14 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature_C14	float	n/a	long_name	standard deviation of band 14 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			units	K	string
			coordinates	band_id_C14 band_wavelength_C14 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C15	int	n/a	long_name	number of good quality band 15 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C15 band_wavelength_C15 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good quality pixels whose values are outside valid measurement range only)	string
min_brightness_temperature_C15	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 15 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C15 band_wavelength_C15 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
max_brightness_temperature_C15	float	n/a	cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
			long_name	maximum top of atmosphere brightness temperature value of band 15 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			coordinates	band_id_C15 band_wavelength_C15 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
mean_brightness_temperature_C15	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 15 good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			valid_range	<i>see note [2]</i>	float
			units	K	string
			coordinates	band_id_C15 band_wavelength_C15 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
std_dev_brightness_temperature_C15	float	n/a	long_name	standard deviation of band 15 top of atmosphere brightness temperature values of good or conditionally usable pixels	string
			standard_name	toa_brightness_temperature	string
			_FillValue	-999.0	float
			units	K	string
			coordinates	band_id_C15 band_wavelength_C15 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string
outlier_pixel_count_C16	int	n/a	long_name	number of good quality band 16 cloud and moisture imagery pixels whose value is outside valid measurement range	string
			_FillValue	-1	int
			units	count	string
			coordinates	band_id_C16 band_wavelength_C16 t y_image x_image	string
			grid_mapping	goes_imager_projection	string
			cell_methods	t: sum area: sum (interval: 0.00056 rad comment: good	string

Variable			Attribute			
Name	Type	Shape	Name	Value	Type	
				quality pixels whose values are outside valid measurement range only)		
min_brightness_temperature_C16	float	n/a	long_name	minimum top of atmosphere brightness temperature value of band 16 good or conditionally usable pixels	string	
			standard_name	toa_brightness_temperature	string	
			_FillValue	-999.0	float	
			valid_range	<i>see note [2]</i>	float	
			units	K	string	
			coordinates	band_id_C16 band_wavelength_C16 t y_image x_image	string	
			grid_mapping	goes_imager_projection	string	
			cell_methods	t: sum area: minimum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string	
max_brightness_temperature_C16	float	n/a	long_name	maximum top of atmosphere brightness temperature value of band 16 good or conditionally usable pixels	string	
			standard_name	toa_brightness_temperature	string	
			_FillValue	-999.0	float	
			valid_range	<i>see note [2]</i>	float	
			units	K	string	
			coordinates	band_id_C16 band_wavelength_C16 t y_image x_image	string	
			grid_mapping	goes_imager_projection	string	
			cell_methods	t: sum area: maximum (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string	
mean_brightness_temperature_C16	float	n/a	long_name	mean top of atmosphere brightness temperature value of band 16 good or conditionally usable pixels	string	
			standard_name	toa_brightness_temperature	string	
			_FillValue	-999.0	float	
			valid_range	<i>see note [2]</i>	float	
			units	K	string	
			coordinates	band_id_C16 band_wavelength_C16 t y_image x_image	string	
			grid_mapping	goes_imager_projection	string	
			cell_methods	t: sum area: mean (interval: 0.000056 rad comment: good	string	

Variable			Attribute			
Name	Type	Shape	Name	Value	Type	
				or conditionally usable quality pixels only)		
std_dev_brightness_temperature_C16	float	n/a	long_name	standard deviation of band 16 top of atmosphere brightness temperature values of good or conditionally usable pixels	string	
			standard_name	toa_brightness_temperature	string	
			_FillValue	-999.0	float	
			units	K	string	
			coordinates	band_id_C16 band_wavelength_C16 t y_image x_image	string	
			grid_mapping	goes_imager_projection	string	
			cell_methods	t: sum area: standard_deviation (interval: 0.000056 rad comment: good or conditionally usable quality pixels only)	string	
percent_uncorrectable_GRB_errors	float	n/a	long_name	percent data lost due to uncorrectable GRB errors	string	
			_FillValue	-999.0	float	
			valid_range	0.0 1.0	float	
			units	percent	string	
			coordinates	t y_image x_image	string	
			grid_mapping	goes_imager_projection	string	
			cell_methods	t: sum area: sum (uncorrectable GRB errors only)	string	
percent_uncorrectable_L0_errors	float	n/a	long_name	percent data lost due to uncorrectable L0 errors	string	
			_FillValue	-999.0	float	
			valid_range	0.0 1.0	float	
			units	percent	string	
			coordinates	t y_image x_image	string	
			grid_mapping	goes_imager_projection	string	
			cell_methods	t: sum area: sum (uncorrectable L0 errors only)	string	
nominal_satellite_subpoint_lat <b>value = 0.00</b>	float	n/a	long_name	nominal satellite subpoint latitude (platform latitude)	string	
			standard_name	latitude	string	
			_FillValue	-999.0	float	
			units	degrees_north	string	
nominal_satellite_subpoint_lon	float	n/a	long_name	nominal satellite subpoint longitude (platform longitude)	string	

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
value = <i>see note [1]</i>			standard_name	longitude	string
			_FillValue	-999.0	float
			units	degrees_east	string
nominal_satellite_height  value = 35786.023	float	n/a	long_name	nominal satellite height above GRS 80 ellipsoid (platform altitude)	string
			standard_name	height_above_reference_ellipsoid	string
			_FillValue	-999.0	float
			units	km	string
geospatial_lat_lon_extent	float	n/a	long_name	geospatial latitude and longitude references	string
			geospatial_westbound_longitude	<i>see note [1]</i>	float
			geospatial_northbound_latitude	<i>see note [1]</i>	float
			geospatial_eastbound_longitude	<i>see note [1]</i>	float
			geospatial_southbound_latitude	<i>see note [1]</i>	float
			geospatial_lat_center	<i>see note [1]</i>	float
			geospatial_lon_center	<i>see note [1]</i>	float
			geospatial_lat_nadir	0.0	float
			geospatial_lon_nadir	<i>see note [1]</i>	float
			geospatial_lat_units	degrees_north	string
			geospatial_lon_units	degrees_east	string
algorithm_dynamic_input_data_container	int	n/a	long_name	container for filenames of dynamic algorithm input data	string
			input_ABI_L2_auxiliary_data	<i>refer to filename conventions for L2+ products in Appendix A.</i>	string
			input_ABI_L1b_radiance_band_1_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_2_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_3_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string

Variable			Attribute		
Name	Type	Shape	Name	Value	Type
			input_ABI_L1b_radiance_band_4_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_5_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_6_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_7_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_8_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_9_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_10_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_11_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_12_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_13_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_14_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_15_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
			input_ABI_L1b_radiance_band_16_data	<i>refer to filename conventions for L1b products in Appendix A of PUG L1b volume.</i>	string
processing_parm_version_container	int	n/a	long_name	container for processing parameter filenames	string
algorithm_product_version_container	int	n/a	long_name	container for algorithm package filename and product version	string
			algorithm_version	<i>refer to filename conventions for L2+ algorithm packages in Appendix A.</i>	string
			product_version	<i>format is vVVRR where VV is major release # and RR is</i>	string

Variable			Attribute					
Name	Type	Shape	Name	Value			Type	
				<i>minor revision #.</i>				

Note 1: Coverage region and horizontal spatial resolution related sizing and extent variable and attribute values are located in paragraph 4.2.6, Product Data Structures, and paragraph 4.2.7, Standard Coordinate Data, in the ABI Fixed Grid section.

Note 2: Cloud and Moisture Imagery Product quantity characteristics are located in paragraph 5.1.6.4, Cloud and Moisture Imagery Quantity Characteristics.

Note 3: Flag values and meanings are located in paragraph 5.1.6.4, Cloud and Moisture Imagery Data Quality Values and Meanings.

#### 5.1.6.4 Cloud and Moisture Imagery Quantity Characteristics

**Table 5.1.6.4 Cloud and Moisture Imagery Quantity Characteristics**

ABI Band	Central wavelength (in $\mu\text{m}$ )	Horizontal Spatial Resolution (in km at nadir)	Horizontal Spatial Resolution (in radians)	Fill Value (packed - scaled integer form)	Bit Depth	Scaled Integer to Physical Quantity Conversion		Valid Range (packed - scaled integer form)		Valid Range (in units of physical quantity)	
						Scale Factor	Add Offset	Minimum	Maximum	Minimum	Maximum
1	0.47	1.0	0.000028	65535	10	0.00024420	0.0	0	4095	0.0	1.0
2	0.64	0.5	0.000014	65535	12	0.00024420	0.0	0	4095	0.0	1.0
3	0.865	1.0	0.000028	65535	10	0.00024420	0.0	0	4095	0.0	1.0
4	1.378	2.0	0.000056	65535	11	0.00024420	0.0	0	4095	0.0	1.0
5	1.61	1.0	0.000028	65535	10	0.00024420	0.0	0	4095	0.0	1.0
6	2.25	2.0	0.000056	65535	10	0.00024420	0.0	0	4095	0.0	1.0
7	3.9	2.0	0.000056	65535	14	0.00982726	173.15	0	16383	173.15	334.15
8	6.185	2.0	0.000056	65535	12	0.03931624	173.15	0	4095	173.15	334.15
9	6.95	2.0	0.000056	65535	11	0.03931624	173.15	0	4095	173.15	334.15
10	7.34	2.0	0.000056	65535	12	0.03931624	173.15	0	4095	173.15	334.15
11	8.5	2.0	0.000056	65535	12	0.03931624	173.15	0	4095	173.15	334.15
12	9.61	2.0	0.000056	65535	11	0.03931624	173.15	0	4095	173.15	334.15
13	10.35	2.0	0.000056	65535	12	0.03931624	173.15	0	4095	173.15	334.15
14	11.2	2.0	0.000056	65535	12	0.03931624	173.15	0	4095	173.15	334.15
15	12.3	2.0	0.000056	65535	12	0.03931624	173.15	0	4095	173.15	334.15

						Scaled Integer to Physical Quantity Conversion		Valid Range (packed - scaled integer form)		Valid Range (in units of physical quantity)	
ABI Band	Central wavelength (in $\mu\text{m}$ )	Horizontal Spatial Resolution (in km at nadir)	Horizontal Spatial Resolution (in radians)	Fill Value (packed - scaled integer form)	Bit Depth	Scale Factor	Add Offset	Minimum	Maximum	Minimum	Maximum
16	13.3	2.0	0.000056	65535	10	0.03931624	173.15	0	4095	173.15	334.15

### 5.1.6.5 Cloud and Moisture Imagery Data Quality Flag Values and Meanings

**Table 5.1.6.5Cloud and Moisture Imagery Data Quality Flag Values and Meanings**

flag_values	flag_meanings
0	good_pixel
1	conditionally_usable_pixel
2	out_of_range_pixel
3	no_value_pixel

11 March 2014